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SILVER BOW CREEK

REMEDIAL INVESTIGATION FINAL REPORT

APPENDIX F

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SILVER BOW CREEK REMEDIAL INVESTIGATION
DRAFT FINAL REPORT

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QUALITY ASSURANCE/QUALITY CONTROL
PROGRAM REPORT

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under contract No. 50341-1202503

June 1986

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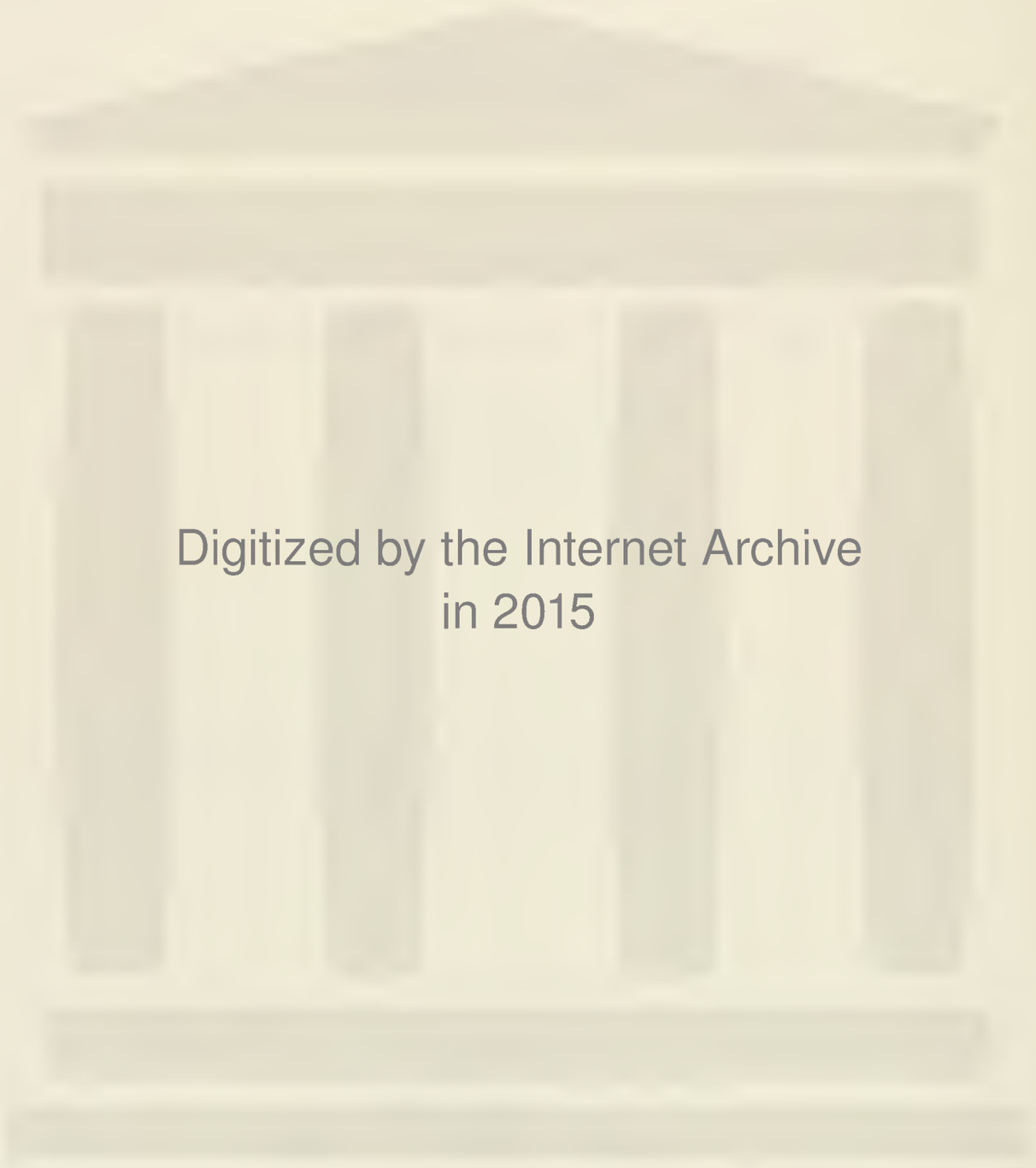

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PREFACE

Silver Bow Creek originates north of Butte, Montana and is a major tributary to the upper Clark Fork River. Mill tailings and other mining wastes in and near the creek contribute to substantial downstream contamination, particularly by potentially toxic elements: arsenic, cadmium, copper, lead, iron, and zinc. These elements and others were present in the mine ore and remain as by-products of the milling and smelting processes.

The history of mining in the Butte area began with the discovery of placer gold in Silver Bow Creek, in late summer of 1864. Several townsites and camps sprung up among the diggings. However, these operations were short-lived, and most of the miners left by 1869. Those who stayed began prospecting the quartz lode deposits of silver and the associated complex copper ores on the Butte Hill. Their efforts culminated in a silver rush, which began in the mid-1870's and revived the old camp. During that time world-class deposits of copper ore were identified. By 1881, Butte had become one of the nation's major mining centers; the district attained national dominance in copper mining by the mid-1890's and international prominence by the turn of the century. By 1915, Anaconda Copper Mining Company led the industry; but in 1980, in response to a depressed copper market, Anaconda closed all the underground mines and continued active mining only in the Berkeley Pit (established in 1955). In 1977, Anaconda became a subsidiary of Atlantic Richfield Company (ARCO). ARCO closed the Berkeley Pit in 1982 and the East Berkeley pit in 1983.

In addition to mining, various ore processing facilities also operated in the Butte area. The first two mills were erected in 1874 to smelt gold and silver. Ten years later, Marcus Daly, one of the founders of the Anaconda Company, built a copper smelter 27 miles west of Butte and planned the city of Anaconda. The Anaconda Smelter was moved to a new location in the city in 1900, and operated from 1903 to 1980.

The history of over 100 years of continuous mining and related activities changed the area's natural environment greatly. Early mining, milling, and smelting wastes were dumped directly into Silver Bow Creek and transported downstream to the Clark Fork River. In 1911, the first treatment pond was built by Anaconda Company near Warm Springs, Montana, to settle out wastes from Silver Bow Creek before the water was allowed to move on. In 1916 and 1959, two more treatment ponds began operation. Silver Bow Creek continued to receive raw mining and milling wastes until 1972, when a treatment plant was added to the Weed Concentrator in Butte. Creek contamination problems were compounded by urban and domestic sewage, wood products treatment plants, phosphate and manganese production facilities, and chemical factories.

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In 1983, the U.S. Environmental Protection Agency (USEPA) designated Silver Bow Creek, contiguous portions of the upper Clark Fork River, and their environs as a high priority Superfund clean-up site. The site extends from Butte to Deer Lodge, Montana, generally following the course of Silver Bow Creek and the upper Clark Fork River. Because the various mining activities interrupted the natural flow of Silver Bow Creek, the beginning of the creek for this investigation was established as the confluence of the Metro Storm Drain and Blacktail Creek, within the city limits of Butte. The site begins at the start of the Metro Storm Drain and ends at the Kohrs Bridge north of Deer Lodge.

The Silver Bow Creek Remedial Investigation (SBC RI) project consisted of coordinated individual studies to develop data on the extent and severity of contamination within the site. Results of the studies are reported in several volumes. A Summary Final Report discusses the entire project; final reports for each individual study have been issued as appendices to the Summary, as shown below:

- Surface Water and Point Source Investigation, Appendix A, Parts 1-3;
- Ground Water and Tailings Investigation, Appendix B, Parts 1-3;
- Warm Springs Ponds Investigation, Appendix C;
- Algae Investigation, Appendix D, Part 1;
- Vegetation Mapping, Appendix D, Part 2;
- Agriculture Investigation, Appendix D, Part 3;
- Macroinvertebrate Investigation, Appendix E, Part 1;
- Bioassay Investigation, Appendix E, Part 2;
- Fish Tissue Investigation, Appendix E, Part 3;
- Waterfowl Investigation, Appendix E, Part 4; and
- Laboratory Quality Assurance/Quality Control Program, Appendix F.

The Solid and Hazardous Waste Bureau (SHWB) of the Montana Department of Health and Environmental Sciences (MDHES) administered the USEPA appropriations to conduct this project. The Montana SHWB program manager was Mr. Michael Rubich. MDHES contracted with MultiTech in October 1984 to perform the SBC RI under contract No. 50341-1202503. The Project Manager at MultiTech was Mr. Gordon Huddleston.

MultiTech was assisted in the SBC RI work by Stiller and Associates of Helena and various other subcontractors. Several state and federal agencies also provided technical information and expertise, including the USEPA bioassay team, the Montana Department of Fish, Wildlife and Parks, the Montana Water Quality Bureau, and the USEPA Montana Field Office.

Information developed in the SBC RI will be used in the next phase of the project, the Feasibility Study, to evaluate options for site remediation.

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EXECUTIVE SUMMARY

To insure that information developed during the performance of the Silver Bow Creek (SBC) Remedial Investigation (RI) met the legal and scientific requirements for RI data, a Quality Assurance (QA) Plan was developed by MultiTech in 1984, before the actual RI work started. This QA Plan was approved by the Montana Department of Health and Environmental Sciences and was reviewed by the U.S. Environmental Protection Agency (USEPA) Region VIII Quality Assurance Team. The QA Plan is summarized in this report and important features of the plan are discussed in some detail.

The quality assurance/quality control (QA/QC) objectives are guided by the general requirements to produce data which is technically and legally defensible. The procedural requirements of the plan which were followed to meet these objectives are described. Compliance with specific USEPA criteria for RI data also is described, and corresponding documentation specific to the SBC RI is listed. The information in this report serves as a reference to gage the general quality of the data, its suitability for use in evaluating contaminant problems on this CERCLA site, and its applicability for development of mitigating measures during the subsequent Feasibility Study.

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1.0 INTRODUCTION

The objective of the Silver Bow Creek Remedial Investigation (SBC RI) was to determine the extent and severity of contamination in Silver Bow Creek and the Upper Clark Fork River, Montana (Map 1-1). A description of the major events that led to the contamination of this system is found in Figure 1-1; the major sources of contaminants are tailings deposits and contaminated ground water (See SBC RI Surface Water and Ground Water Reports, Appendices A and B). The major contaminants being investigated by the SBC RI were arsenic (As), cadmium (Cd), copper (Cu), iron (Fe), lead (Pb), and zinc (Zn).

Data developed by the SBC RI will be used to evaluate human and environmental risk from the contaminants and to identify potential remedial actions. These activities will take place during the next phase of the "CERCLA" process - the Feasibility Study.

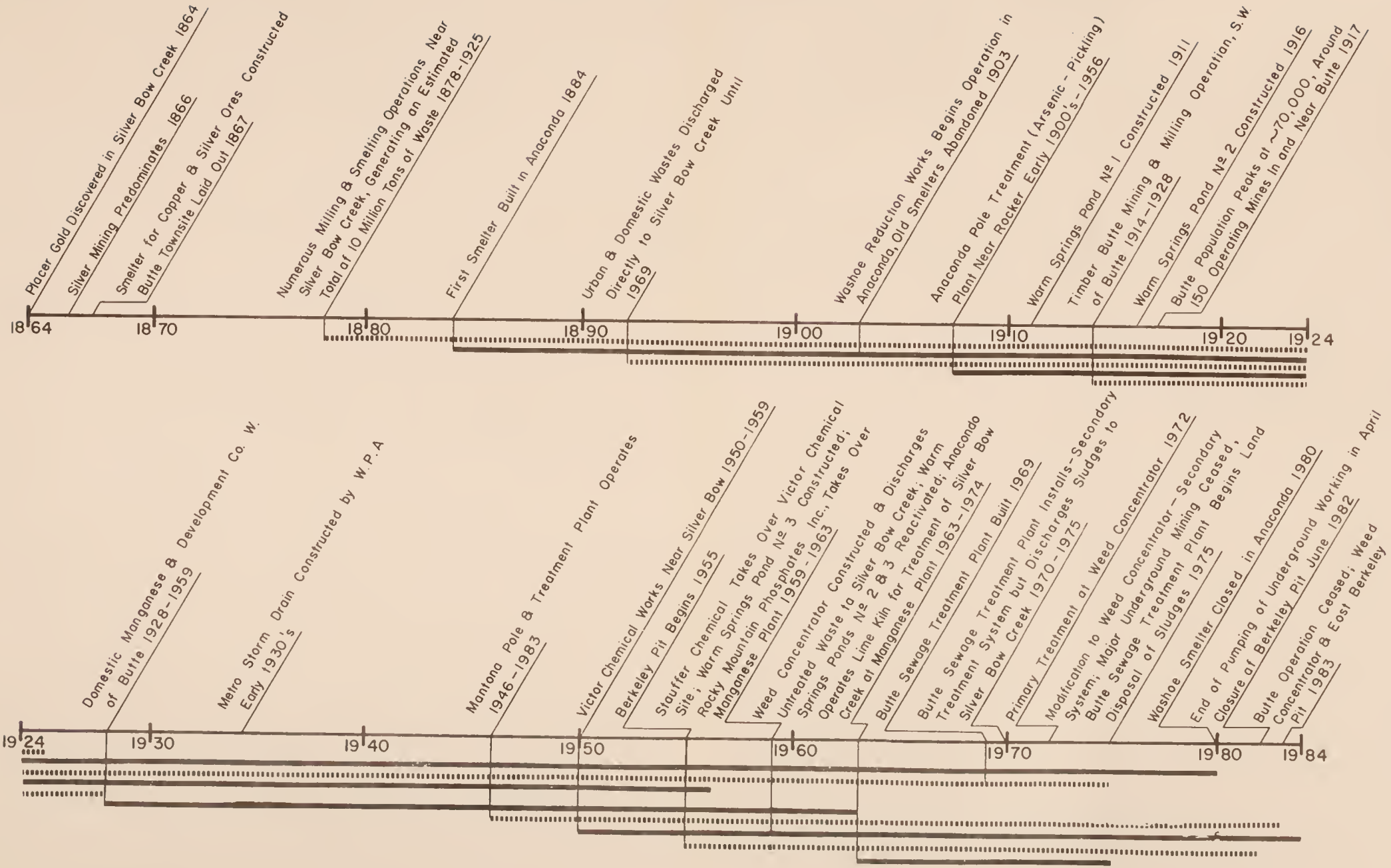
To insure that the data developed during the SBC RI met the legal and scientific requirements for RI data, a Quality Assurance Plan (QA Plan) was prepared during the planning phases to guide the acquisition of SBC RI data. This report documents the implementation of the SBC RI QA Plan.

The SBC RI QA Plan provides in specific terms the policies, organization, objectives, functional activities, and specific quality assurance (QA) and quality control (QC) objectives and activities

CONTINENTAL DIVIDE
YANKEE DOODLE POND
BERKELEY PIT
BUTTE
BLACKTAIL CR.
BASIN CR
LITTLE BASIN CR
CLARK TAILINGS
COLORADO TAILINGS
ROCKER
BROWNS GULCH
SILVER BOW
RAMSAY
DAWSON
MILES CROSSING
SCALE 1" = 2.27 MILES
COTTONWOOD CR.
PETERSEN CR.
CARIBOU CR.
DRY COTTONWOOD CR
CLARK FORK
DEER LODGE
DEMPSEY
GALEN
WARM SPRINGS PONDS
WARM SPRINGS
FLINT CR.
SILVER BOW CREEK
GERMAN GULCH
FAIRMONT HOT SPRINGS
TAYLOR CR
POWELL CR.
DEMPSEY CR
RACETRACK CR
MODESTY CR
LOST CR
WARM SPRINGS CR.
MILL CR.
WILLOW CR
SILVER BOW CREEK
MAP 1-1
SILVER BOW CREEK
and UPPER
CLARK FORK RIVER

FIGURE 1-1

HISTORIC CONTAMINATION OF SILVER BOW CREEK


Placer Gold Discovered in Silver Bow Creek 1864
Silver Mining Predominates 1866
Smelter for Copper & Silver Ores Constructed
Butte Townsite Laid Out 1867
Numerous Milling & Smelting Operations Near Silver Bow Creek, Generating an Estimated Total of 10 Million Tons of Waste 1878-1925
First Smelter Built in Anaconda 1884
Urban & Domestic Wastes Discharged Directly to Silver Bow Creek Until 1969
Washoe Reduction Works Begins Operation in Anaconda, Old Smelters Abandoned 1903
Anaconda Pole Treatment (Arsenic-Pickling) Plant Near Rocker Early 1900's-1956
Warm Springs Pond Nº 1 Constructed 1911
Timber Butte Mining & Milling Operation, S.W. of Butte 1914-1928
Warm Springs Pond Nº 2 Constructed 1916
Butte Population Peaks at ~70,000, Around 150 Operating Mines In and Near Butte 1917
1864
1870
1880
1890
1900
1910
1920
1924
Domestic Manganese & Development Co. of Butte 1928-1959
Metro Storm Drain Constructed by W.P.A Early 1930's
Montana Pole & Treatment Plant Operates 1946-1983
Victor Chemical Works Near Silver Bow 1950-1959
Berkeley Pit Begins 1955
Stauffer Chemical Site; Warm Springs Pond Nº 3 Constructed; Rocky Mountain Phosphates Inc. Takes Over Manganese Plant 1959-1963
Takes Over Victor Chemical
Weed Concentrator Constructed & Discharges Untreated Waste to Silver Bow Creek; Warm Springs Ponds Nº 2 & 3 Reactivated; Anaconda Operates Lime Kiln for Treatment of Silver Bow Creek at Manganese Plant 1963-1974
Butte Sewage Treatment Plant Built 1969
Butte Sewage Treatment Plant Installs-Secondary Treatment System but Discharges Sludges to Silver Bow Creek 1970-1975
Primary Treatment at Weed Concentrator 1972
Modification to Weed Concentrator-Secondary System; Major Underground Mining Ceased; Butte Sewage Treatment Plant Begins Disposal of Sludges 1975
Washoe Smelter Closed in Anaconda 1980
End of Pumping of Underground Working in April Closure of Berkeley Pit June 1982
Butte Operation Ceased; Weed Concentrator & East Berkeley Pit 1983
1924
1930
1940
1950
1960
1970
1980
1984

necessary to meet the goals of the project. Although frequently used interchangeably, the terms quality assurance and quality control refer to two different concepts. Quality assurance is the "system for ensuring that all information, data, and resulting decisions compiled under a specific task are technically sound, statistically valid, and properly documented" (USEPA 1982). Quality control is the "mechanism through which quality assurance achieves it goals" (USEPA 1982a).

The objectives of this QA report are as follows:

- Distribute to SBC RI Report readers a summary of the SBC RI Quality Assurance Plan;
- Document that the data meet EPA QA/QC criteria for RI data;
- Document the implementation of the QA Plan;
- Document the external QA/QC audit findings;
- Document and summarize QA/QC decisions; and
- Discuss SBC RI Data Quality objectives.

1.1 PLAN DEVELOPMENT

Multitech prepared the SBC RI QA Plan from January to July of 1984 1984 under contract to the Montana Department of Health and Environmental Sciences. Guidance from the U.S. Environmental Protection Agency (USEPA) available at that time was Interim Guidelines and Specifications For Preparing Quality Assurance Project Plans (USEPA 1980). MultiTech received a draft copy of Evaluation Criteria for

Existing Data From CERCLA Study Areas (USEPA, No Date) on June 13, 1984, and a final draft of that document on February 5, 1985 (USEPA 1985). The SBC RI QA Plan was prepared without the aid of these evaluation criteria, but as this document will show, the QA/QC requirements outlined by the SBC RI QA Plan and implemented during the SBC RI met the criteria. USEPA's guidance document on developing Data Quality Objectives (DQO's) was not available until after the SBC RI planning and field work were completed.

Preliminary review comments on the draft QA Plan were received from the USEPA Region and Quality Assurance Office on June 4, 1984, after the draft QA Plan had been revised by MultiTech responding to Montana Department of Health and Environmental Sciences (MDHES) comments. The final SBC RI QA/QC Plan was delivered by MultiTech to MDHES on July 24, 1984. MultiTech was awarded the SBC RI contract in November 1984, and began work using the SBC RI QA Plan.

A revision of the SBC RI Plan was submitted by MultiTech to MDHES on February 19, 1985 for approval. This revised SBC RI QA/QC Plan was proposed to streamline documentation while maintaining essential elements, to address sampling and analysis techniques not foreseen during the initial drafting of the QA Plan, and to address the USEPA's June comments. With the exception of method detection limit (MDL) goals, the revisions were approved for implementation by MDHES. The MDL goals were revised and approved as discussed in Section 2.2.6.

The Montana Office of the USEPA received Region 8 QA Office comments on the revision on July 19, 1985 and subsequently delivered them to MultiTech. However, the field work portion of the RI was complete except for one sampling episode in August 1985 and no changes were made to the revised SBC RI QA Plan in response to these comments.

1.2 LOCATION OF QUALITY ASSURANCE PLAN

Copies of the SBC RI QA Plan are located at MultiTech Offices in Butte, Montana and in the offices of the Solid and Hazardous Waste Bureau, Montana Department of Health and Environmental Sciences, Helena, Montana. A summary of the SBC RI QA Plan is found in this report.

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2.0 SUMMARY OF QUALITY ASSURANCE PLAN

The Silver Bow Creek Remedial Investigation (SBC RI) Quality Assurance (QA) Plan was written following the guidance of the U.S. Environmental Protection Agency (USEPA) (1980). The following sections summarize the Revised RI QA Plan submitted to MDHES on February 19, 1985.

2.1 CHAPTER 1: INTRODUCTION

The Introduction of the SBC RI QA Plan describes the SBC Remedial Investigation/Feasibility Study (RI/FS) project, the CERCLA process, the role of the SBC RI QA Plan, and the QA project organization. Figure 2-1 shows the CERCLA process as applied to Silver Bow Creek, Figure 2-2 shows the overall project organization, and Figure 2-3 shows the QA organization.

2.2 CHAPTER 2: OUALITY ASSURANCE (OA) OBJECTIVES FOR MEASUREMENT DATA

This section of the SBC RI QA Plan defines the measurements used for evaluating or determining accuracy, precision, completeness, representativeness, comparability, and method detection limits (MDL). It also discusses the criteria used to set needed MDLs.

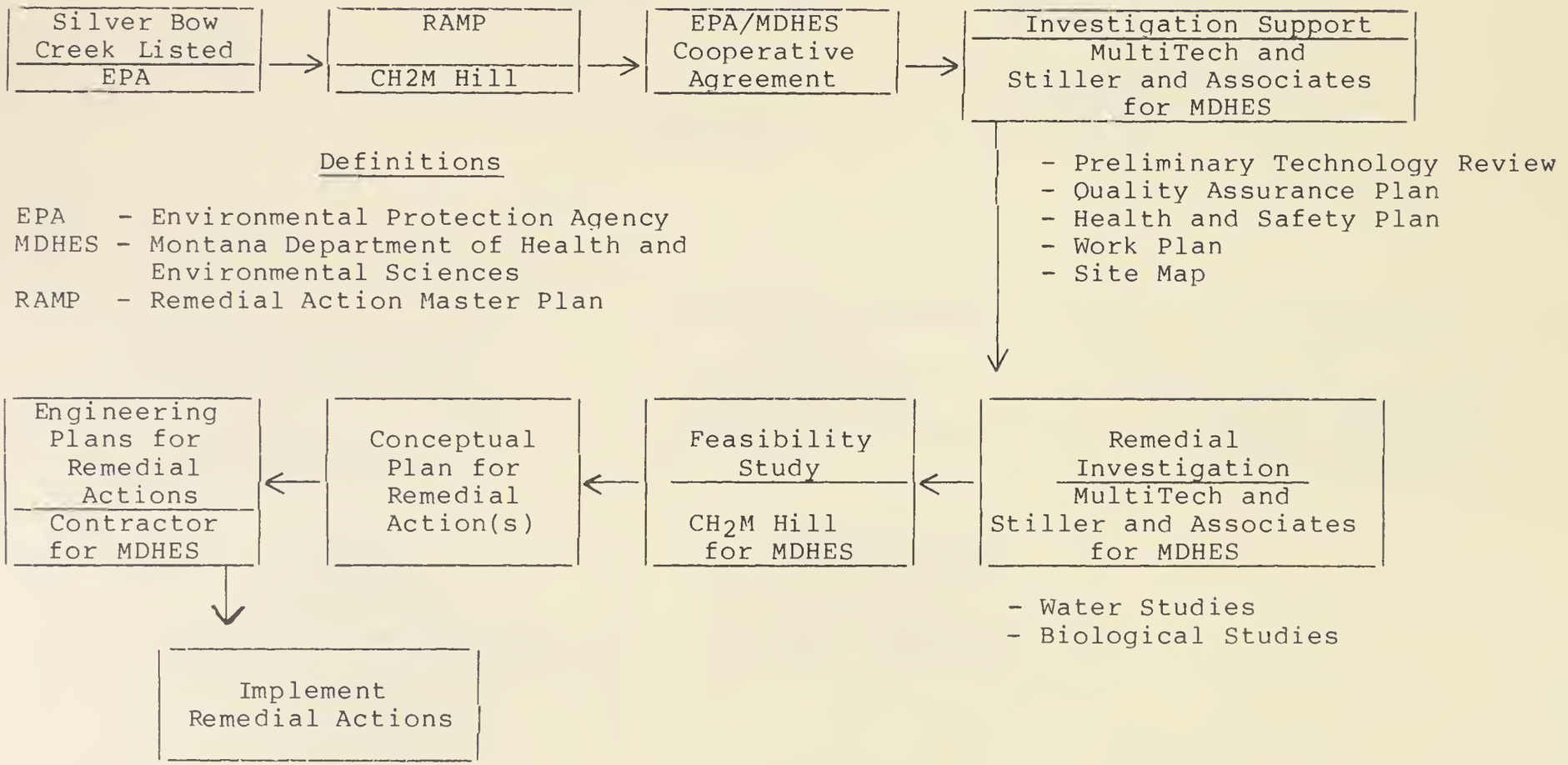


FIGURE 2-1.--SILVER BOW CREEK CERCLA PROCESS

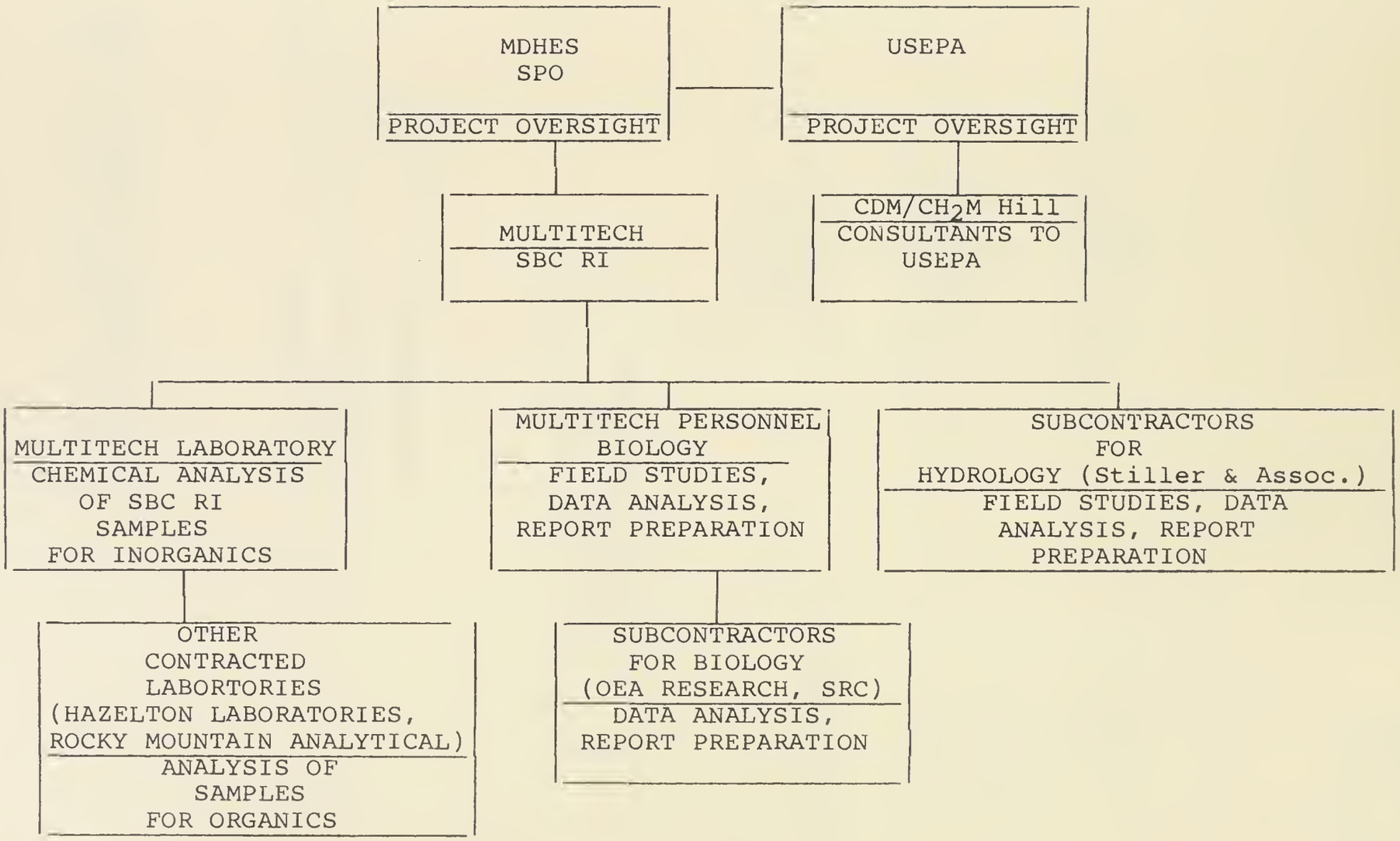
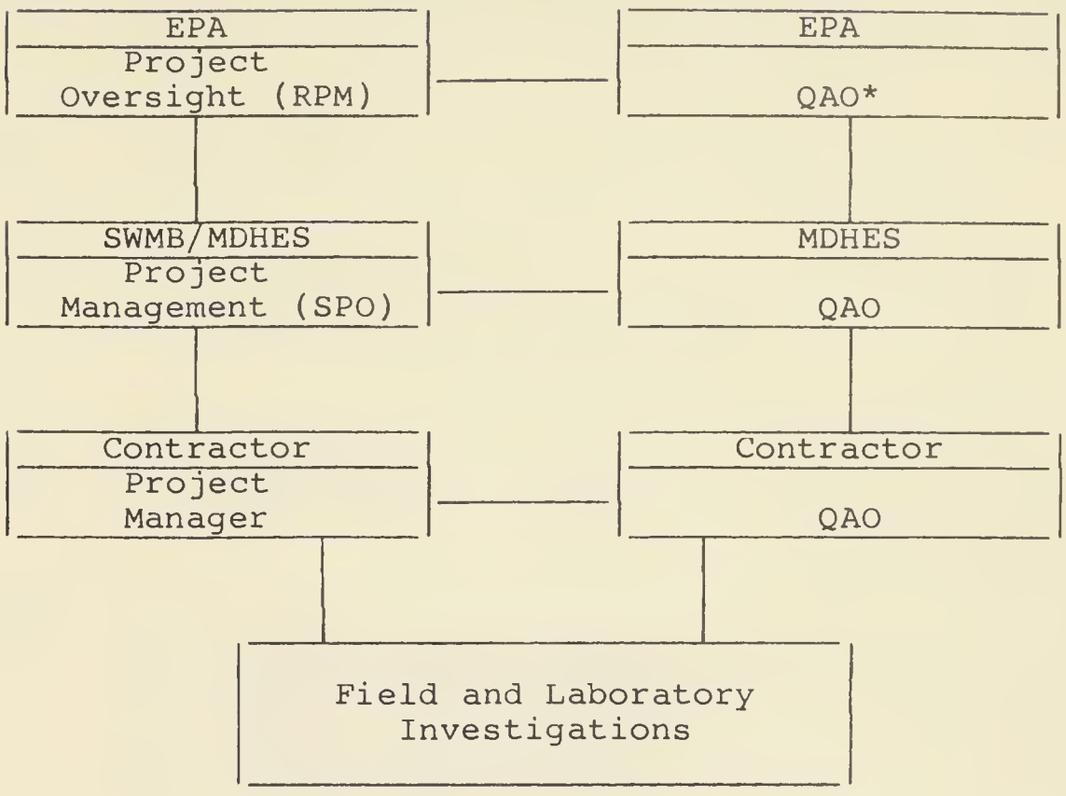


FIGURE 2-2
SBC RI PROJECT ORGANIZATION



EPA QAO Lee Shanklin

MDHES QAO Mike Rubich

Contractor QAO Robert Trout

* QAO = Quality Assurance Officer
RPM = Remedial Project Manager
SPO = State Project Officer

FIGURE 2-3.--PROJECT ORGANIZATION

2.2.1 Accuracy

Accuracy was monitored by known sample agreement percent (KSA%) and Spike Sample Agreement percent (SSR%) values, defined as:

$$KSA\% = \frac{X}{T} * 100\%$$

where: X = measured value

T = "True" or accepted value

$$SSR\% = \frac{X_2 - (X_1)\ (D_1)}{(S)\ (D_2)} * 100\%$$

where: X_1 = Sample concentration
X_2 = Spiked sample concentration
D_1 = Sample dilution factor
S = Spike concentration
D_2 = Spike dilution factor

2.2.2 Precision

Precision was monitored using Duplicate Sample Agreement percent (DSA%) and Replicate Sample Agreement percent (RSA%) values, defined as:

$$DSA\% = \frac{d_1}{(d_1+d_2)/2} * 100\%$$

where: d_1 = first sample result
d_2 = second sample result

$$RSA\% = \frac{r_1}{(r_1 + r_2)/2} * 100\%$$

where: r_1 = First measured value
r_2 = Second measured value

Duplicates are two separate samples representing similar conditions. Replicates are two measurements of the same sample.

2.2.3 Completeness

Completeness percent was determined by:

$$\text{Completeness } \% = \frac{NV}{NT} * 100\%$$

where: NV = number of validated measurements
NT = expected number of measurements

2.2.4 Representativeness

Representativeness is a qualitative term which expresses the degree to which data accurately and precisely represent a characteristic of a population, variations at a sampling site location, a process condition, or an environmental condition.

Representative data has two important properties. First, it is an accurate indicator of a measured condition of the system sampled at a particular time and place. This property was evaluated by field

duplicates for the SBC RI. Secondly, there is complete certainty that the measurement reported can be ascribed to a particular sample which was taken at a particular time and place. This was achieved for the SBC RI by use of rigorous systems for chain-of-custody, sample handling, and data management.

2.2.5 Comparability

Comparability is a qualitative characteristic which expresses the confidence with which one data set can be compared to another. A basis for comparability for the SBC RI was established by use of EPA standard methods, where available, and by the use of fully documented methods where EPA standard methods were not available.

2.2.6 Method Detection Limit

The method detection limit (MDL) was defined as the concentration of analyte which would yield an analyte signal three times greater than the standard deviation of at least three (3) replicate measurements of a blank signal or low level standard.

During the preparation of the SBC RI QA plan the MDL goals were set as 20% of the USEPA Primary and Secondary Drinking Water standards for those parameters for which standards existed (Federal Register, March 12, 1982). MDLs not set by the above criteria were set to levels found to be reasonably achievable by EPA laboratory surveys (USEPA 1983a; USEPA 1982a).

The Revised SBC RI QA Plan submitted to MDHES on February 19, 1985 corrected some MDL goals for metals to agree with the 20% drinking water standard criteria. This proposed revision raised a significant discussion among data users about MDL goals and the criteria used to select them. Some data users advocated aquatic life criteria for setting MDL's, others advocated the 20% drinking water standard, and others advocated a compromise.

Because meeting the aquatic life criteria for some metals would have required extreme low-level analysis techniques with consequent additions in analysis costs, this criterion was rejected. Instead, where applicable, the MDL goals were set to match the MDL requirements of the USEPA Contract Lab Program. The final Revised SBC QA Plan MDLs, as adopted, are shown in Tables 2-1 and 2-2.

2.2.7 Aqueous Solutions and Solid Samples

QA objectives for aqueous solutions for accuracy, precision, MDLs, and completeness are shown in Tables 2-1 and 2-2. Accuracy and precision objectives (KSA%, SSR%, DSA%, or RSA%) were required to be met by the analyst in the laboratory or the sample set associated with an out-of-control accuracy or precision sample were to be repeated. Out-of-control externally prepared samples (sample bank or field) used for evaluating accuracy and precision did not require re-analysis, but were used for qualitative evaluations of the data.

TABLE 2-1.--QA OBJECTIVES FOR ACCURACY, PRECISION, METHOD DETECTION LIMIT, AND COMPLETENESS FOR AQUEOUS SAMPLES

Measurement/ Method	Reference[a]	RSA(%)[b] DSA(%)[b] & KSA(%)[b]	SSR(%)[c]	MDL (mg/l)	Completeness
pH/Electrometric	150.1	≤± 0.1 pH	N.A.	N.A.	90%
Specific Conductance/ Conductimetric	120.1	85-115	N.A.	1µmho/cm	90%
Temperature/ Thermometric	170.1	≤±1°C	N.A.	N.A.	90%
Total Dissolved Solids/ Gravimetric	160.1	75-125	N.A.	10.	90%
Total Suspended Solids Residue/Gravimetric	160.2	75-125	N.A.	4.	90%
Acidity/Titrimetric	305.1	90-110	N.A.	20.	90%
Alkalinity/Titrimetric, Colorimetric	310.1 or 310.2	90-110	N.A.	20.	90%
Hardness/Colorimetric, Titrimetric	130.1 or 130.2	90-110	75-125	20.	90%
Sodium/Atomic Absorption Spectroscopy (AAS) or ICPAES	273.1	90-110	75-125	5.00	90%
Potassium/AAS or ICPAES	258.1	80-120	75-125	5.00	90%
Calcium/AAS or ICPAES	215.1	90-110	75-125	5.00	90%
Magnesium/AAS or ICPAES	242.1	90-110	75-125	5.00	90%
Chloride/Colorimetric, Titrimetric	325.1, 325.2, or 325.3	90-110	75-125	10.	90%
Fluoride/ Potentiometric	340.2	90-110	75-125	0.30	90%
Nitrate/Colorimetric Potentiometric	352.1	90-110	75-125	2.0	90%
Sulfate/Turbidimetric	375.4	90-110	75-125	5.0	90%
Sulfide/Titrimetric, Colorimetric	376.1 or 376.2	90-110	75-125	0.05	90%

TABLE 2-1.--QA OBJECTIVES FOR ACCURACY, PRECISION, METHOD DETECTION LIMIT, AND COMPLETENESS FOR AQUEOUS SAMPLES (CONTINUED)

Measurement/ Method	Reference[a]	RSA(%)[b] DSA(%)[b] & KSA(%)[b]	SSR(%)[c]	MDL (mg/l)	Complete-ness
Orthophosphate, Total/ Colorimetric	365.1, 365.2 365.3 or 365.4	90-110	75-125	0.02	90%
Ammonia Nitrogen/ Potentiometric	350.3	90-110	75-125	0.10	90%
Cyanide, Total/ Titrimetric	335.2	90-110	75-125	0.010	90%
Kjeldahl Nitrogen, Total/Colorimetric, Titrimetric	351.1, 351.2, 351.3, or 351.4	70-130	60-140	2.0	90%
Aluminum/AAS	202.1 or 202.2	85-115	75-125	0.2	90%
Antimony/AAS	204.1 or 204.2	85-115	75-125	0.06	90%
Arsenic/AAS-Hydride	206.2 or 206.3	85-115	75-125	0.010	90%
Barium/AAS	208.1 or 208.2	85-115	75-125	0.200	90%
Beryllium/AAS	210.1 or 210.2	90-110	75-125	0.005	90%
Boron/AAS	212.3	85-115	75-125	0.100	90%
Cadmium/AAS	213.1 or 213.2	90-110	75-125	0.005	90%
Chromium/AAS	218.1 or 218.2	85-115	75-125	0.010	90%
Cobalt/AAS	219.1 or 219.2	90-110	75-125	0.050	90%
Copper/AAS or ICPAES	220.1 or 220.2	85-115	75-125	0.025	90%

TABLE 2-1.--QA OBJECTIVES FOR ACCURACY, PRECISION, METHOD DETECTION LIMIT, AND COMPLETENESS FOR AQUEOUS SAMPLES (CONTINUED)

Measurement/ Method	Reference[a]	RSA(%)[b] DSA(%)[b] & KSA(%)[b]	SSR(%)[c]	MDL (mg/l)	Complete-ness
Iron/AAS or ICPAES	236.1 or 236.2	85-115	75-125	0.100	90%
Lead/AAS	239.1 or 239.2	85-115	75-125	0.005	90%
Manganese/AAS	243.1 or 243.2	85-115	75-125	0.015	90%
Mercury/AAS-Cold Vapor	245.1 or 245.2	85-115	75-125	0.0002	90%
Molybdenum/AAS	246.1 or 246.2	90-110	75-125	0.200	90%
Nickel/AAS	249.1 or 249.2	90-110	75-125	0.040	90%
Phosphorous, Total	365.2 or 365.3	90-110	75-125	0.020	90%
Selenium/AAS	270.2 or 270.3	85-115	75-125	0.005	90%
Silver/AAS	272.1 or 272.2	90-110	75-125	0.010	90%
Thallium/AAS	279.1 or 279.2	85-115	75-125	0.010	90%
Tin/AAS	282.1 or 282.2	90-110	75-125	0.040	90%
Vanadium/AAS	286.1 or 286.2	90-110	75-125	0.050	90%
Zinc/AAS or ICPAES	289.1 or 289.2	85-115	75-125	0.020	90%

TABLE 2-1.--QA OBJECTIVES FOR ACCURACY, PRECISION, METHOD DETECTION LIMIT, AND COMPLETENESS FOR AQUEOUS SAMPLES (CONTINUED)

Measurement/ Method	Reference[a]	RSA(%)[b] DSA(%)[b] & KSA(%)[b]	SSR(%)[c]	MDL (mg/l)	Complete-ness
Pentachlorophenol/ Gas Chromatography (GC)	604	90-110	75-125	0.014	90%
Polychlorinated Biphenyls (PCB)	-	-	-	-	-
PCB-1016/GC	608	90-110	75-125	0.050	90%
PCB-1221/GC	608	90-110	75-125	0.050	90%
PCB-1232/GC	608	90-110	75-125	0.050	90%
PCB-1242/GC	608	90-110	75-125	0.050	90%
PCB-1248/GC	608	90-110	75-125	0.050	90%
PCB-1254/GC	608	90-110	75-125	0.050	90%
PCB-1260/GC	608	90-110	75-125	0.050	90%

Notes: [a] Reference numbers for parameters pH through Zinc refer to Method numbers in Methods for Chemical Analysis of Water and Wastes, (USEPA 1983a). Other reference numbers refer to EPA Method Numbers given in Methods for Organic Chemical Analysis of Municipal and Industrial Waste Water, (USEPA 1982a).

[b] or ±1 times the listed MDL, if the measured value is ≤ 5 times the listed MDL.

[c] spike at 100% to 200% of the measured concentration or 3 to 4.5 times the listed MDL, whichever is greater.

TABLE 2-2.--QA OBJECTIVES FOR ACCURACY, PRECISION, METHOD DETECTION LIMIT, AND COMPLETENESS FOR SUSPECTED LIQUID HAZARDOUS WASTES

Measurement/ Method	Reference[a]	RSA(%)[b] DSA(%)[b] & KSA(%)[b]	SSR(%)[c]	MDL (mg/l)	Complete-ness
Arsenic/AAS-Hydride	7060 or 7061	90-110	75-125	1.0	95%
Barium/AAS	7080 or 7081	90-110	75-125	20.0	95%
Cadmium/AAS	7130 or 7131	90-110	75-125	0.2	95%
Chromium/AAS	7190, 7191, 7195, 7196, or 7197	90-110	75-125	1.0	95%
Lead/AAS	7420 or 7421	90-110	75-125	1.0	95%
Mercury/AAS-Cold Vapor	7470	90-110	75-125	0.04	95%
Selenium/AAS	7740 or 7741	90-110	75-125	0.20	95%
Silver/AAS	7760 or 7761	90-110	75-125	1.0	95%

Note: [a])Reference numbers refer to method numbers in Test Methods for Evaluating Solid Wastes, (USEPA 1982b).

[b])or $\pm$ 1 times the listed MDL, if the measured value is $\leq$ 5 times the listed MDL.

[c])spike at 100% to 200% of the measured concentration or 3 to 4.5 times the listed MDL, whichever spike level is greater.

2.3 CHAPTER 3: SAMPLING PROCEDURES

This chapter of the SBC RI QA Plan describes the field equipment and procedures used for SBC RI sampling, the decontamination procedures used, the sample containers that were used for SBC RI samples, the preservation technique and holding times for each parameter, sample tampering precautions, sample identification procedures, field notebooks, and field QA/QC Samples.

The QA Plan describes the sampling procedures briefly, as detailed descriptions of sampling plans were documented in the SBC RI Work Plan, (MultiTech and Stiller and Associates 1985) a companion document to the QA Plan. Field equipment was also described briefly for the same reason. Table 2-3 lists the sampling containers, preservation techniques, and holding times for each SBC RI parameter measured. Sample-tampering precautions are noted in this chapter. Detailed descriptions of chain-of-custody requirements are given in a separate chapter of the QA Plan.

An example sample ID tag is shown in Table 2-4. The data shown on this example tag were put on each sample container used for the SBC RI, as appropriate. Standardized field forms were used for recording field data. These forms were copied by the sample bank and filed, with the originals remaining with the sampling personnel.

Two types of field QA/QC samples were generated by the sampling crews. Each batch of 40 samples was accompanied by a field blank,

TABLE 2-3.--SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIME

Sample Matrix	Parameters	Preservation Technique[1]	Container	Volume of Sample	Field Decontamination Technique	Holding Time[2]
Water	pH, SC, TDS, TSS, SO_4^{-2}, Alk, Cl^-, Fl^-, NO^{-3}, NO_2^-	Cool to <4°C	2-1 qt. cubes or 1 2 qt. plastic btl.	Fill Containers	Rinse 3 times with sample	7 days (24 hours for NO_3^- and NO_2^-)
Water	NH_4^+, Kheldahl N, Total P, COD	H_2SO_4 < pH 2 Cool to < 4°C	32 oz poly	Fill Container	Rinse 3 times with sample	24 hours for Total P, 28 days for others
Water	Ortho PO_4^{-3}	Filter to <.45 micron, Cool to < 4°C	8 oz narrow mouth poly bottle	Fill Container	Rinse 3 times with filtered sample	48 hours
Water	S^{-2}	2 mls Zinc Acetate, NaOH to > pH 9 Cool to < 4°C	16 oz poly bottle	500 ml	Rinse 3 times with sample	7 days
Water	Dissolved Metals and Hardness	Filter to < .45 micron, 2 ml HNO_3 Cool to < 4°C	8 oz wide mouth round poly bottle	200 ml	Rinse 3 times with filtered sample	6 months
Water	Total Metals	2 ml HNO_3, Cool to < 4°C	8 oz square poly bottle	200 ml	Rinse 3 times with sample	6 months
Water	BOD	Cool to < 4°C	1 qt. cube	Fill Container	Rinse 3 times with sample	48 hours
Water	Coliforms	Cool to < 4°C	Prepared Whirl-pak®	To Mark	None	6 hours

TABLE 2-3.--SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIME (CONTINUED)

Sample Matrix	Parameters	Preservation Technique[1]	Container	Volume of Sample	Field Decontamination Technique	Holding Time[2]
Water	PCP	H_2SO_4 to < pH 2 Cool to < 4°C	32 oz clear glass with aluminum foil lined cap	1 L	Rinse 3 times with sample	24 hours
Water	PCB	Cool to < 4°C	32 oz amber glass with aluminum foil lined cap	1 L	No pre-collection rinse	Extracted in 7 days. Analyzed within 30 days
Water	Oil and Grease	H_2SO_4 to < pH 2 Cool to < 4°C	32 oz glass with foil lined cap	1 L	Rinse 3 times with sample	28 days
Water	Cyanide	NaOH to pH > 12 Cool to < 4°C	32 oz poly bottle	1 L	Rinse 3 times with sample	14 days
Tailings	All	Cool to ≤ 4°C	Two 42 oz Whirl-pak® bags	Fill bags (1 kg each)	N.A.	N.A.
Vegetation	All	Cool to < 4°C	Paper Lunch Bag	0.5 kg	N.A.	6 months
Soil	All except N	Cool to ≤ 4°C	42 oz Whirl-pak®	Fill Bag 1 kg	N.A.	6 months

TABLE 2-3.--SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIME (CONTINUED)

Sample Matrix	Parameters	Preservation Technique[1]	Container	Volume of Sample	Field Decontamination Technique	Holding Time[2]
Livestock Blood	All	Cool to < 4°C, ammonium heparin	10 ml monovent	4 monovents ea. at 10 ml in Whirl-pak®	N.A.	6 months
Livestock Hair	All	Cool to ≤ 4°C	2 oz Whirl-pak® bag	Three 2 oz Whirl-paks® with ≤ 4 gm/bag for ≤ 12 gm sample	N.A.	6 months
Wildlife Tissue	All	Cool to < 4°C then freeze	18 oz Whirl-pak® bag	Whole organ or sample	N.A.	6 months

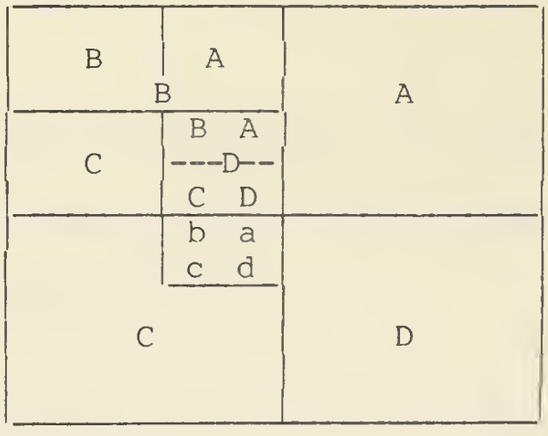
a) Source: USEPA 1983b.

TABLE 2-4.--SAMPLE IDENTIFICATION TAG

	SBC- _____ _____ _____ Station Date No.	_____N _____W _____ _____ _____ T R S 1/64S No.
	Sample Type: _____ Comp. Int. Grab Preservative: _____ Time: _____ Sampler(s): _____ For: _____ Comments: _____	

Instructions

Station	SSXXX	Surface Water Stations
	GWXXX	Ground Water Stations
	PSXXX	Point Source Station
Date	XXXXXX (Month, Year, Date)	
No.	XX	Sample Number for a station sampled several times on the same day.
T	XX	Township N
R	XX	Range W
S	XX	Section 1-36
1/64S	XXXX	1/64 Section Use
No.	Sample Number for more than one sample from a 10-acre site.	



Sample Type = Water, Soil, Tailings, Vegetation, Tissue
Circle Appropriate Method.
Preservative: Indicate Preservative Used.
Time: Indicate Time of Sample Acquisition (military time).
Sampler(s): Names of Sampler(s).
For: Organizations of Sampler(s).
Comments: Additional notes regarding sample.

which consisted of a reagent grade deionized water treated in the same manner as the sample (i.e. filtered and acidified). Each batch of 20 samples was accompanied by a field duplicate, which consisted of a second sample collected in the same place and at nearly the same time as possible as the first.

2.4 CHAPTER 4: CREATION AND IMPLEMENTATION OF THE SAMPLE BANK

A sample bank was created by MultiTech to handle the record filing, sample storing, container dispensing, analysis assigning, QA sample preparing, and chain-of-custody documenting required by the SBC RI QA Plan. Chapter 4 of the QA Plan describes the operation of the sample bank. Procedures for issuing supplies, accepting and logging in samples, assigning laboratory numbers and creating and numbering QA/QC samples are described.

Table 2-5 lists all QA/QC samples required for this project. Table 2-6 defines each sample type. Figures 2-4 and 2-5 are flow diagrams illustrating the preparation of QA/QC samples.

2.5 CHAPTER 5: CHAIN-OF-CUSTODY PROCEDURES

This chapter of the SBC RI QA Plan describes the chain-of-custody procedures and documentation used on the SBC RI. The chain-of-custody form used is shown in Figure 2-6. Chain-of-custody procedures for most of the SBC RI samples consisted of field crews releasing samples to the sample bank, where the designated sample

TABLE 2-5.--SCHEDULE OF FIELD GENERATED AND SAMPLE BANK GENERATED QA/QC SAMPLES

TYPE OF QA/QC SAMPLE	MATRIX				
	Water[1]	Soil[1]	Tailings[1]	Vegetation[1]	Tissue[1,2]
Field Duplicate	1/20	1/40	1/40	1/40	1/40 muscle 2/20 blood
Field Blank	1/40	1/40	1/40	1/40	1/40
SB Reagent Blank	1/40	1/40	1/40	1/40	1/40
SB Spike (Straight, Extract or Total Digest)[1]	1/40	1/40	1/40	1/40	1/40
SB Standard[4]	1/40	1/40	1/40	1/40	1/40
SB Spike Duplicate	0/40	0/40	0/40	0/40	1/40
SB Blind Split (of Original Processed Material)	0/40	1/40	1/40	1/40	1/40
Referee Lab Duplicate	1/40	1/40	1/40	1/40	1/40
SB Split Extract (Partial)	N.A.	1/40	1/40	0/40	0/40
SB Split Digest (Total)	1/40	1/40	1/40	1/40	1/40
Lab Calibration Checks[3,4]	1/10	1/10	1/10	1/10	1/10
Lab Spikes	1/10	1/10	1/10	1/10	1/10
Lab Replicate Analyses	1/10	1/10	1/10	1/10	1/10
Lab Blanks	1/20	1/20	1/20	1/20	1/20

[1] Spikes for some measurements are inappropriate.

[2] As appropriate, whole tissues will not have duplicates.

[3] Mid-range calibration check.

[4] Can be prepared from NBS-SRMs, EPA check standards, or laboratory prepared stock solutions. If laboratory stock solutions are used they must not be the same solutions used to prepare analysts' calibration standards.

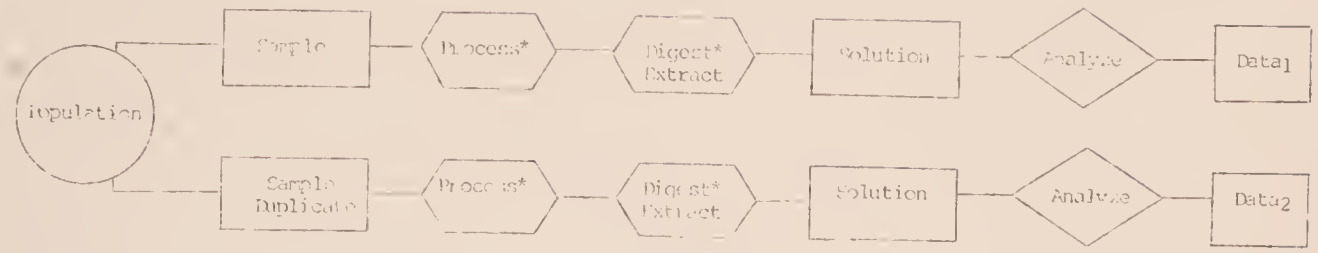
TABLE 2-6.--QA/QC SAMPLE DEFINITIONS

QC Sample Type	Where Generated	Definition
Field Duplicate	Sampling Site	A second sample is acquired from the sampling location. Data are used to evaluate precision.
Field Blank	Sampling Site	A sample of DI water is prepared in the same manner as the environmental sample. Data are used to assess potential contamination.
Sample Bank Reagent Blank	Sample Bank (not blind to analyst)	A sample is prepared for analysis using only preparation and/or digestion reagents. Data are used to assess for contamination.
Sample Bank Spike	Sample Bank	A spike of known concentration is added to an unknown. Type of spike and point in processing is shown in Figure 4-2. Data are used to evaluate accuracy.
Sample Bank Standard	Sample Bank	An NBS-SRM, EPA check standard or stock solution is processed, digested, or extracted, as appropriate and submitted to the analysts. Data are used to evaluate accuracy.
Sample Bank Spike Duplicate	Sample Bank	This is a special case for blood samples. As these samples arrive at the sample bank as a set of four duplicates, one of the four is spiked and submitted for analysis. Data are used to evaluate accuracy.
Sample Bank Blind Split	Sample Bank	An unknown is split prior to processing or digesting/extracting. Data are used to evaluate precision.

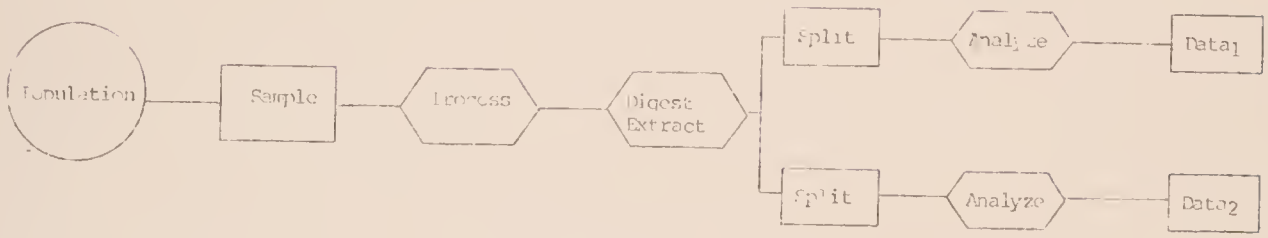
TABLE 2-6.--QC SAMPLE DEFINITIONS (CONTINUED)

QC Sample Type	Where Generated	Definition
Sample Bank Split Extract	Sample Bank	An unknown is split following extraction. Data are used to evaluate precision.
Sample Bank Split Digestion	Sample Bank	An unknown is split following digestion. Data are used to evaluate precision.
Lab Calibration Check	Analytical Lab	A EPA check, NBS-SRM or independently prepared stock solution is measured during batch runs. Data are used to immediately check accuracy.
Lab Spikes	Analytical Lab	A spike is added to the unknown by the analyst. Data are used to immediately measure recovery efficiencies of analysis (accuracy).
Lab Replicates	Analytical Lab	The analysts remeasures an unknown a second time following batch run. Data are used to immediately measure analysis precision.
Referee Lab Duplicate	Sample Bank	An unknown is split prior to processing or digesting/extracting. One of the splits is shipped to a referee lab for processing, digestion/extracting, and analysis. Data are used to evaluate precision.
Lab Blank	Analytical Lab	For use by analyst.

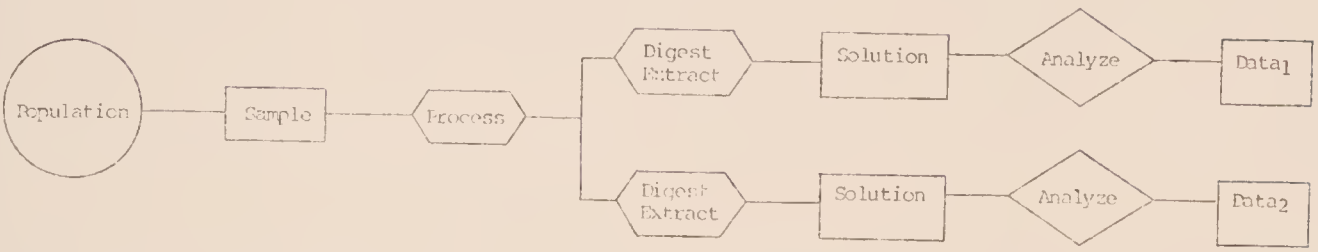
FIELD DUPLICATE



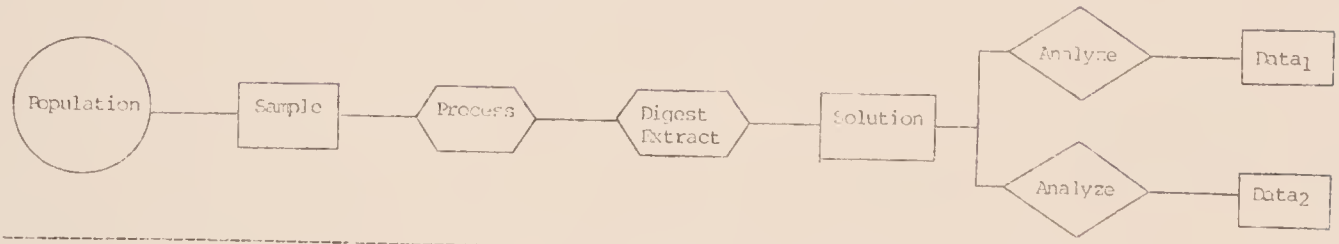
SB DIGEST/EXTRACT SPLIT



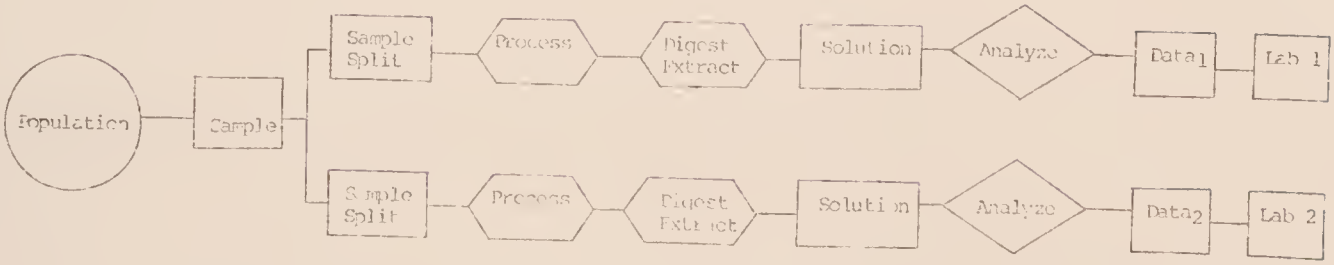
SB BLIND SPLIT (OF PROCESSED MATERIAL)



LAB REPLICATE



REFEREE LAB DUPLICATE



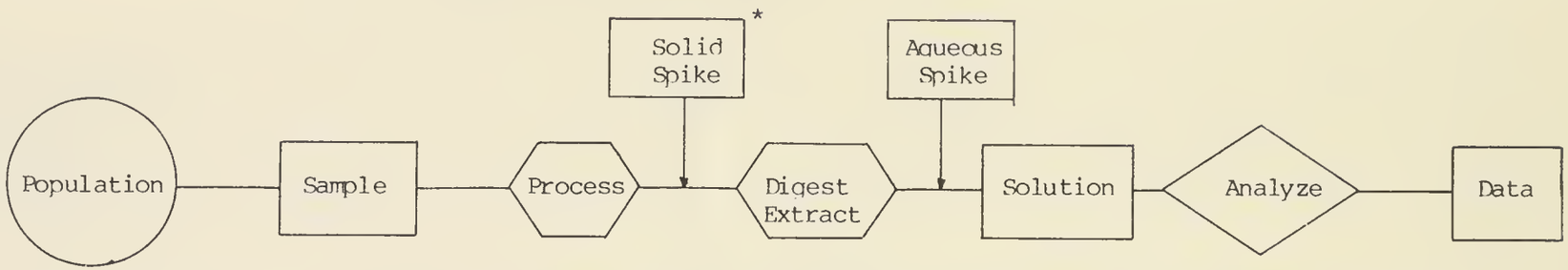
Duplicate Agreement Factor:

$$DAF = \frac{d_1}{(d_1 + d_2)/2} \quad (100)$$

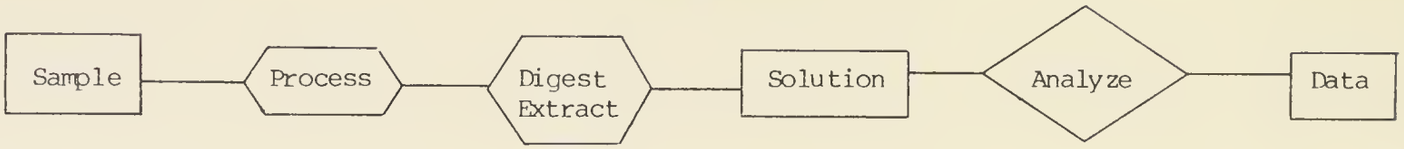
* Water samples are not processed. Only total metals analyses require digestions of water.

FIGURE 2-4.--QC SAMPLES FOR PRECISION EVALUATIONS

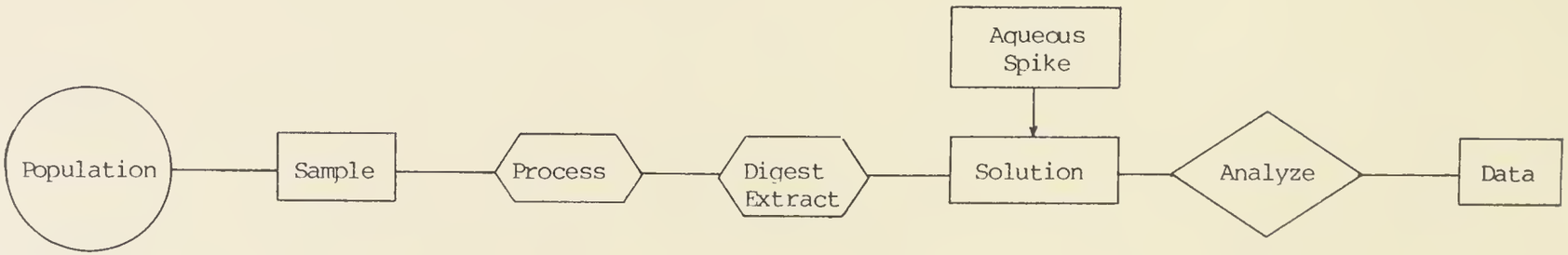
SB SPIKE



NBS STANDARD



LAB SPIKES



*Applies only to total digests of solid materials.

Accuracy = A

$$A = \frac{X - T}{T} \quad 100$$

Where T = True Value
X = Measured Value

FIGURE 2-5.--QC SAMPLES FOR ACCURACY EVALUATIONS

CHAIN OF CUSTODY RECORD

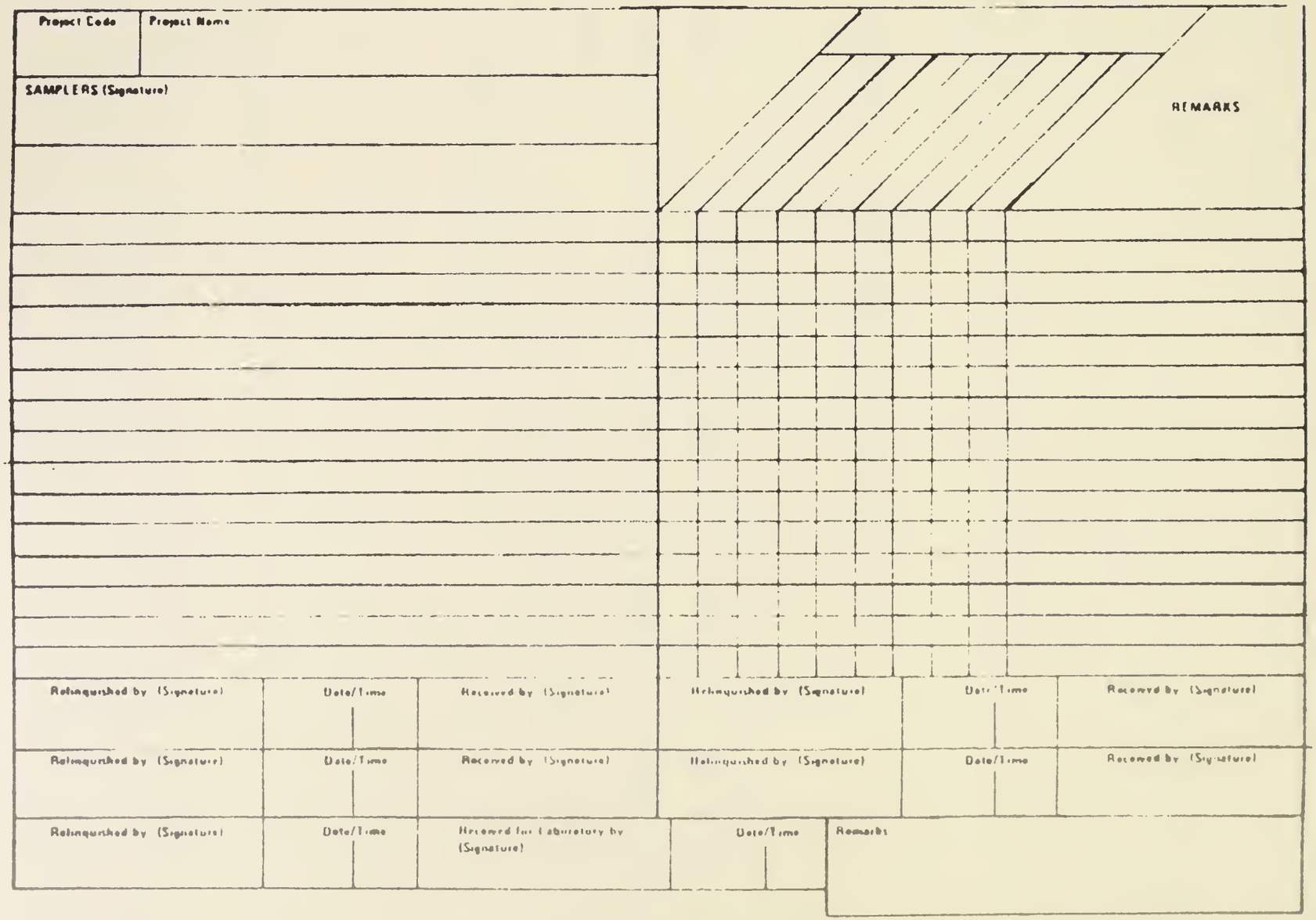


FIGURE 2-6.--CHAIN-OF-CUSTODY REPORT (USEPA 1983b)

custodian received the samples for analysis. Because MultiTech's lab was located very near the site, no shipping was performed for these samples and shipping chain-of-custody was not a concern.

The sample custodian then notified analysts of requested analyses by filling out an Analysis Assignment Form. This form is shown in Figure 2-7. The custodian then released the samples to the analysts, who performed the analyses, and then returned the samples to the sample custodian.

2.6 CHAPTER 6: INSTRUMENT CALIBRATION

The schedules and procedures for calibrating field and laboratory instruments are described in Chapter 6 of the SBC RI QA Plan. The field and lab calibration schedules are shown in Tables 2-7 and 2-8, respectively. Calibration instructions for instruments not listed in these tables were described in the text of the QA Plan and are summarized below:

Analytical Balance

Analytical balances were calibrated according to the following information:

> Weigh a set of class S weights ranging from 1 to 100 g on the analytical balance(s) used during this study at the beginning of the study and repeat every 21 days. If any of the readings do not agree within ± 0.2 mg with the stated value, recalibrate the balance. Record the results of all balance checks in the balance log book. (Calibration also was performed whenever the analytical balance was moved or subjected to rough handling or to cleaning.)

ANALYSIS ASSIGNMENT

Assigned to: _____

Date Assigned: _____

Completed on time? ☐ yes ☐ no

Lab Nos._____ to _____

Lab Nos._____

Field Nos._____ to _____

Batch Identifier (if any) _____

Analysis needed by: _____
date

Preparation by: _____ Prepared samples will be available by: _____
(name) (date)

Analyze samples for _____ using
(parameter)

(description of procedure or method) _____

_____

_____

_____

_____

QC requirements (frequencies)

_____ midrange calibration checks _____ analysis replicates

_____ analysis blanks _____ analysis spikes (50-200%)

_____

_____

Date analysis completed (to be filled in by analyst): _____
(date)

When analysis is completed place samples in _____
(location)

and give this sheet and all associated data sheets to lab coordinator.

Check off completed analyses on laboratory work sheet.

FIGURE 2-7.--ANALYSIS ASSIGNMENT FORM

TABLE 2-7.--SCHEDULE OF FIELD INSTRUMENT CALIBRATION

Instrument	Required Calibrations
pH Meter	1) Calibrate according to manufacturer's recommendations prior to and following each day's sampling. 2) Check 7.0 standard prior to each sample measurement.
Specific Conductivity Meter	1) Determine probe factor using a KCl standard having a conductance in approximately the same range as samples at least for each sampling day. 2) Make "red-line" check prior to and following each measurement. 3) Calibrate temperature probe with an NBS thermometer once a week.
Dissolved Oxygen Meter	1) Calibrate with Winkler method once a month. 2) Calibrate with saturated water method prior to and following each day's sampling. 3) Calibrate with saturated air method once before each measurement.
Well Probe	1) Calibrate at project initiation and once per month with steel engineers tape.
Flow Meters	1) Calibrated according to manufacturer's instructions at project initiation and once per month thereafter. 2) Spin tests prior to and following each measurement.
Continuous Recorders	1) Calibrated according to manufacturer's instructions upon installation and once per month thereafter.
Continuous Samplers	1) Calibrated according to manufacturer's instructions and once per month thereafter.
Thermometers	1) Calibrate once per month with NBS thermometer.

TABLE 2-8.--LABORATORY INSTRUMENT CALIBRATION SCHEDULE

Instrument	Required Calibrations
Leco® Sulfur Analyzer	1) Calibrate at beginning of each batch according to manufacturer's instructions.
pH/Redox/Specific Ion Meters	1) Calibrate at beginning of each batch according to manufacturer's instructions.
Gas Chromatographs	1) Calibrate at beginning of each batch according to appropriate EPA Method.
Ion Chromatographs	1) Calibrate at beginning of each batch according to manufacturer's instructions.

Atomic Absorption Spectrophotometer and UV-VIS Spectrophotometer

AA's and Spectrophotometers were calibrated according to the following instructions:

> Calibrate with a minimum of one reagent blank and three standards encompassing the concentration range of interest. At least one standard should be below the maximum contaminant level (MCL).
>
> The calibration curve shall be calculated by a polynomial least squares fit of the calibration data such that the degree of the polynomial is not greater than one less than the number of standards. The calibration curve must account for at least 90% of the absorbance variation of the standards. More rigorous calibration criteria may be used if desired.

ICP Emission Spectrometer

Instrument calibration and calibration checks were done as specified in EPA Method 200.7 (USEPA 1983a).

2.7 CHAPTER 7: LABORATORY ANALYTICAL PROCEDURES

Descriptions of labware washing, preparation of stock solutions, analysis methods, records maintenance and reporting requirements are given in Chapter 7 of the SBC RI QA Plan. The analysis methods are presented in Table 2-1 of this report for standard USEPA approved procedures. For non-standard procedures the laboratory documented the procedure used. These procedure descriptions are on file at MultiTech.

2.8 CHAPTER 8: DATA HANDLING, MANAGEMENT AND REPORTING

Chapter 8 of the SBC RI QA Plan describes the data management system used to store and retrieve data. This system is shown graphically in Figure 2-8. Data verification (proofing) and data validation (evaluating external QA sample results) are also described.

2.9 CHAPTER 9: QUALITY CONTROL AND QUALITY ASSURANCE CHECKS

Responses to QA/QC data are described in Chapter 9 of the SBC RI QA Plan, and in Tables 2-9 and 2-10.

2.10 CHAPTER 10: PREVENTIVE MAINTENANCE

Table 2-11 lists the preventive maintenance for instrument used on the SBC RI project. This table comes from Chapter 10 of the SBC RI QA Plan.

2.11 CHAPTER 11: AUDIT AND CORRECTIVE ACTION PROGRAMS

Chapter 11 of the SBC RI QA Plan assumed that MDHES would audit the data production of the SBC RI project. However, the audit of the data production system was performed by the USEPA (or its contractors). The SBC RI QA Plan describes audits of sample collection, chain-of-custody, analytical, and data management. All of these were covered by the USEPA audit except for the sample collection audit. The USEPA audit was conducted on July 10, 1985,

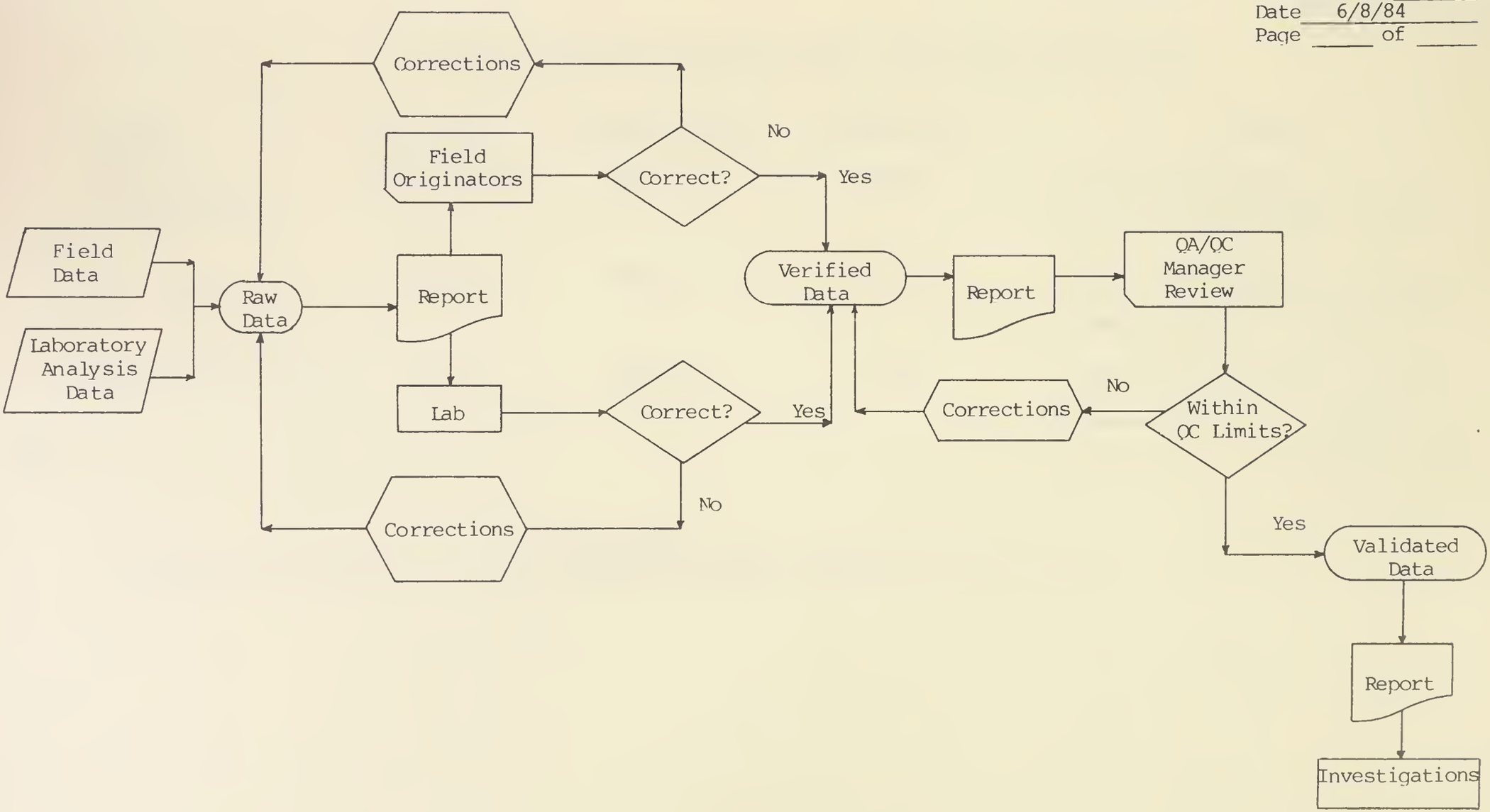


FIGURE 2-8.--DATA FLOW DIAGRAM

TABLE 2-9.--QUALITY CONTROL CHECKS, ACTION LIMITS, AND ACTIONS

QC Check	Calculation	Control Limit	Check Values	Action
Replicate or Duplicate[a]	RSA% or DSA%	Table 2-1	None	1) Check calculations. 2) If out of control, re-analyze. 3) Report DSA% and RSA%.
Spike - Lab	SSR%	Table 2-1	None	1) Check calculations. 2) If out of control, re-analyze. 3) Report SSR%.
Check Standard - Lab	KSA%	Table 2-1	None	1) Check calculations. 2) If out of control, re-analyze. 3) Report KSA%.

[a]A replicate measurement is a second measurement made on the same solution. Duplicate measurements are made on seperate solutions that had the same origins.

TABLE 2-10.--QUALITY ASSURANCE CHECKS, CHECK VALUES, AND ACTIONS

QA Check	Calculation	Check Values	Action
Field Duplicate	DSA%	Table 2-1	1) Check DSA%. 2) If out, check values. Note on QA/QC Reports.
Field Blank	None	None	1) Report values. 2) If above detection limits, investigate to determine cause.
Sample Bank Blanks	None	None	1) Report values. 2) If above detection limits, investigate to determine cause.
Sample Bank Standard	KSA%	Table 2-1	1) Check KSA%. 2) Report KSA%. 3) if out, check values. Note on QA/QC Reports.
Sample Bank Spike	SSR%	Table 2-1	1) Check SSR%. 2) Report SSR%. 3) If out, check values. Note on QA/QC Reports.
Sample Bank Splits (of raw material, digests, or extracts)	DSA%	Table 2-1	1) Check DSA%. 2) Report DSA%. 3) If out, check values. Note on QA/QC Reports.
Referee Lab Duplicates	DSA%	Table 2-1	1) Check DSA%. 2) Report DSA%. 3) If out, check values. Note on QA/QC Reports.

TABLE 2-11.--PREVENTIVE MAINTENANCE SCHEDULE

Instrument	Frequency	Maintenance Check
pH Meters	Daily	Battery check.
	Daily	Check electrode solutions.
	Weekly	Replace batteries.
	Weekly	Check with pH meter tester.
	Continuous	Store electrode in storage solution.
Specific Conductivity Meter	Daily	Battery check.
	Daily	Check cables and switches.
	Weekly	Replace batteries.
	Continuous	Store probes in aqueous solutions.
Dissolved Oxygen Meter	Daily	Battery check.
	Daily	Check cables and switches.
	Weekly	Replace batteries.
	Bi-Weekly	Replace membrane.
	Continuous	Keep membrane moist.
Well Probe	Daily	Battery check.
	Daily	Check graduations.
	Weekly	Replace batteries.
	Weekly	Clean probe with detergent and water.
Flow Meters	Daily	Battery check.
	Daily	Check cables and switches.
	Weekly	Replace batteries.
Continuous Recorders	Monthly	Replace chart.
	Monthly	Replace batteries.
	APMI*	APMI
Continuous Samplers	APMI	APMI
Balance	APMI	APMI
AA Spectrophotometer	APMI	APMI
ICP Spectrophotometer	APMI	APMI
UV Spectrophotometer	APMI	APMI
Leco Sulfer Analyzer	APMI	APMI
Redox/Specific Ion Meters	APMI	APMI
Gas Chromatographs	APMI	APMI
Ion Chromatographs	APMI	APMI

* APMI = As Per Manufacturer's Instructions.

with results forwarded to MultiTech in September 1985. A more detailed discussion of the audit findings are presented in a later section of this report.

Corrective action programs are also described in Chapter 11 of the SBC QA Plan. The Corrective Action Form shown in Figure 2-9 was not used during the SBC RI, instead, long-term corrective action requests were submitted in the form of letters. The QA responses followed the process outlined in the QA Plan and is described in more detail later in this report.

2.12 CHAPTER 12: QUALITY ASSURANCE REPORTING

Continuous and periodic QA reporting are described in Chapter 12 of the SBC RI QA Plan. Continuous reporting described includes QA/QC charts or tables for all measures of precision and accuracy in the QA Plan. Periodic reporting includes all audit results and the reporting of QA/QC data for each set of sample data reported. Continuous QA/QC data are available in MultiTech files. Audit reports have been submitted by the auditing agencies to MultiTech and MDHES. All SBC RI data reports from MultiTech to MDHES are accompanied by a QA/QC summary for each measurement or analysis.

Originator:_____ Date:_____

Person Responsible for Replying:_____ Contract Involved:_____

Description of Problem and When Identified:_____

State Cause of Problem, if Known or Suspected:_____

Sequence of Corrective Action: (If no responsible person is identified, bring this form directly to QA Manager.)

State Date, Person, and Action Planned:

CA Initially Approved By:_____ Date:_____

Follow-Up Dates_____

Final CA Approval By:_____ Date:_____

Information Copies To:

RESPONSIBLE PERSON:_____

QA MANAGER:_____

DEPARTMENT MANAGER:_____

FIGURE 2-9.--CORRECTIVE ACTION REQUEST FORM

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3.0 MEETING U.S. ENVIRONMENTAL PROTECTION AGENCY DATA CRITERIA

The U.S. Environmental Protection Agency (USEPA) released a document Evaluation Criteria For Existing Data from CERCLA Study Areas (USEPA 1985). Since USEPA had not finalized a similar document for RI data, MultiTech decided to have SBC RI data meet these criteria. Three sets of data categories were developed by the USEPA (1985):

"1. Unusable data, i.e., data that should not be considered;

2. Level A, i.e., data that meets the first-level screening criteria but not the second-level criteria. This class of data could be used to help develop or refine study plan, evaluate different sampling, or analysis techniques, or identify gaps in the data base; and

3. Level B, i.e., data that meets both sets of screening criteria. Data submitted meets all criteria and should be fully considered when evaluating conditions such as risks or potential solutions to problems."

SBC RI data were collected in such a way as to meet both Level A and Level B Criteria, for use in evaluating conditions and identifying risks and potential solutions. Table 3-1 lists the Level A and B criteria, the SBC QA Plan way of meeting this criteria with a QA Plan page citation, and the location of supporting documentation showing that the criteria were met.

TABLE 3-1
USEPA CERCLA SITE DATA CRITERIA AND SBC RI DATA

LEVEL A

To meet Level A criteria the following information must be fully documented through sampling and field records or laboratory records.

Criteria	SBC RI QA Plan	Data Location
Sampling date	Section 3.0, page 13	Sample Label/Sample Bank
	Section 3.0, page 15	Field Notebook/Sample Bank, Field Samplers
	Section 4.0, page 4	Lab log book/Sample Bank
	Section 5.0, page 3	Chain-of-Custody Form/Sample Bank, Field Samplers
	Section 8.0, page 2	Analysis Request Form/Sample Bank, Field Samplers
	Not Cited	Final RI Reports
Sampling team or member in charge	Section 3.0, page 13	Sample Label/Sample Bank
	Section 3.0, page 15	Field Notebook/Sample Bank, Field Samplers
	Section 5.0, page 3	Chain-of-Custody Form/Sample Bank, Field Samplers
	Section 8.0, page 2	Analysis Request Form/Sample Bank, Field Samplers
	Not Cited	Final RI Reports
Sampling location within the required tolerances for the study	Section 3.0, page 13	Sample Label/Sample Bank
	Section 3.0, page 15	Field Notebook/Sample Bank, Field Samplers
	Section 5.0, page 3	Chain-of-Custody Form/Sample Bank, Field Samplers
	Not Cited	Final RI Reports
Physical description of sampling location	Section 3.0, page 5	Field Notebook/Sample Bank, Field Samplers
	Not Cited	Final RI Reports
Sampling depth	Section 3.0, page 13	Sample Label/Sample Bank
	Section 3.0, page 15	Field Notebook/Sample Bank, Field Samplers
	Not Cited	Final RI Reports

TABLE 3-1
USEPA CERCLA SITE DATA CRITERIA AND SBC RI DATA (Continued)

LEVEL A

To meet Level A criteria the following information must be fully documented through sampling and field records or laboratory Records.

Criteria	SBC RI QA Plan	Data Location
Sampling Collection Technique	Section 3.0, page 15 Not Cited	Field Notebook/Sample Bank, Field Samplers Final RI Reports
Field Preparation Technique	Section 3.0, page 13 Section 3.0, page 15 Not Cited	Sample Label/Sample Bank Field Notebook/Sample Bank, Field Samplers Final RI Reports
Sample Preservation Techniques	Section 3.0, pages 10-12 Section 3.0, page 15 Section 5.0, page 3	Sample Label/Sample Bank Field Notebook/Sample Bank, Field Samplers Chain-of Custody Form/Sample Bank, Field Samplers
Sample Shipping Date	Section 4.0, page 5	Lab Log Book/Sample Bank
Laboratory Analysis Date	Not Cited Not Cited	Analysis Assignment Form/Sample Bank Analysis Data Sheets/Sample Bank
Laboratory Analysis Method	Not Cited Not Cited	Analysis Assignment Form/Sample Bank Laboratory Preparation Sheets/Sample Bank
Laboratory Analysis Methods	Section 2.0, page 5-9	Analysis Assignment Form/Sample Bank Analysis Data Sheets/Sample Bank
Laboratory analysis detection limit either by specific notation or reference method	Section 2.0, page 4 Not Cited	Analysis Data Sheets/Sample Bank Data Reports (<MDL reported at <MDL value)

TABLE 3-1
USEPA CERCLA SITE DATA CRITERIA AND SBC RI DATA (Continued)

LEVEL A

To meet Level A criteria the following information must be fully documented through sampling and field records or laboratory records.

Criteria	SBC RI QA Plan	Data Location
Comparison sampling efforts such as crops or livestock	SBC RI Work Plan (Agricultural Investigation)	Agricultural Investiagtion Report
Visual classification of sample using an accepted classification system	SBC RI Work Plan (Agricultural Investigation and Ground Water and Tailing Investigation)	Field Notebooks/Sample Bank, Field Sampler SBC RI Final Reports

Level B

Only data which has met level A criteria will be considered for level B. To meet level B criteria the following information must be fully documented.

Criteria	SBC RI QA Plan	Data Location
Documentation of laboratory/field instrumentation and standardization and methods (other than a reference)	Not Cited	Field procedures were documented in the SBC RI Work Plan. Lab Procedures were documented in MultiTech's Laboratory Standard Operating Procedures Manual.

TABLE 3-1
USEPA CERCLA SITE DATA CRITERIA AND SBC RI DATA (Continued)

Level B

Only data which has met level A criteria will be considered for level B.
To meet level B criteria the following information must be fully documented.

Criteria	SBC RI QA Plan	Data Location
Sample bottle preparation	Section 7.0, page 1	Posted at washing area.
Procedural reference and or calibration data	Section 6, pages 1-5	Calibration procedures given in QA Plan. Calibration data on each laboratory analysis sheet.
Verification of standards using EPA or NBS reference materials not less than once each three months	Section 4.0, page 8	EPA calibration checks were performed at the rate of 1 in 10 by the analyst. Sample bank-generated EPA or NBS standard samples were submitted for blind analysis at the rate of 1 in 40 or fraction thereof. QA/QC data for these checks are presented in the QA/QC Summaries which accompanied each laboratory data report set.
Analysis of laboratory reagent blanks at a frequency of at least 1 per 20 samples	Section 4.0, page 8	Field blanks (1 in 40 or fraction thereof), sample bank blanks (1 in 40 or fraction thereof), and lab blanks (1 in 20 or fraction thereof) were analyzed. Field blanks were reported as part of a laboratory report data set, sample bank blanks were reported in the accompanying QA/QC Summaries. Lab blanks were not reported but were used for blank subtractions and MDL determinations.

TABLE 3-1
USEPA CERCLA SITE DATA CRITERIA AND SBC RI DATA (Continued)

Level B

Only data which has met level A criteria will be considered for level B. To meet level B criteria the following information must be fully documented.

Criteria	SBC RI QA Plan	Data Location
Analysis of lab replicates at a frequency of at least 1 per 20 samples.	Section 4.0, page 8	Lab replicates were done at the rate of 1 per 10 samples. Data were reported on lab report QA/QC Summaries.
Analysis of laboratory spikes at a frequency of at least 1 per 20 samples if the analyte is amenable to spiking.	Section 4.0, page 8	Lab spikes were done at the rate of 1 per 10 samples. Blind sample bank spikes were done at the rate of 1 per 40 samples or fraction thereof. Data were reported on lab report QA/QC Summaries.
Analysis of field replicates (duplicates or splits) at a frequency of at least 1 per 20 samples.	Section 4.0, page 8	Field duplicates were done at the rate of 1 per 20 samples or fraction thereof. Analysis data were reported in the Lab report data set. QA/QC data were reported on the accompanying QA/QC Summaries.
Presentation of tabulated QC data or QC charts/ acceptance criteria	Section 2.0, page 1 Section 2.0, pages 5-9	Each laboratory data report set was accompanyied by QA/QC Summaries for each analysis of the set. These QA/QC Summaries compared the QA/QC data to the acceptance criteria found in Section 2.0 of the SBC QA Plan.

TABLE 3-1
USEPA CERCLA SITE DATA CRITERIA AND SBC RI DATA (Continued)

Level B

Only data which has met level A criteria will be considered for level B.
To meet level B criteria the following information must be fully documented.

Criteria	SBC RI QA Plan	Data Location
QA/QC Certification of the laboratory and/ or participation in round-robin testing by and/or with EPA accredited agencies	Not Cited	MultiTech's laboratory was/is certified by the Montana Department of Health and Environmental Science for drinking water analyses. Certification documentation is available at MultiTech or MDHES. MultiTech participates in USEPA's round-robin testing. Documentation is available at MultiTech or USEPA.
QC limits shall be consistant with the limits established for EPA's contract lab program.	Not Cited.	QC check formulas and acceptance criteria (KSA%, RSA%, DSA%, SSR%) were approved by MDHES prior to project personnel acquiring a copy of the USEPA CLP Users Guide.
Field custody noted in field logbook or transfer-of-custody documentation available.	Section 3.0, page 15 Section 5.0, page 3	Field Notebooks/Sample Bank, Field samplers Chain-of-Custody/Sample Bank, Field samplers
Samples hand delivered to laboratory or transfer-of-custody documentation available.	Section 3.0, page 15 Section 5.0, page 3	Field Notebooks/Sample Bank, Field samplers Chain-of-Custody/Sample Bank, Field samplers
Laboratory custody documented by transfer-of-custody documentation from either field personnel or shipper.	Section 5.0, page 3	Chain-of-Custody Form/Sample Bank, Field Samplers

TABLE 3-1
USEPA CERCLA SITE DATA CRITERIA AND SBC RI DATA (Continued)

Level B

Only data which has met level A criteria will be considered for level B. To meet level B criteria the following information must be fully documented.

Criteria	SBC RI QA Plan	Data Location
Laboratory custody documented through designated laboratory sample custodian with secured sample storage area.	Section 4.0, pages 1-12	MultiTech operated a Sample Bank as described in the SBC RI QA Plan.
Sample designation number(s) traceable through entire monitoring system.	Section 4.0, page 2	Lab Logbook/Sample Bank
Field notebooks and all custody documents stored in a secure repository or under the control of a document custodian.	Section 4.0, page 6	Chain-of-Custody Forms/Sample Bank, Field Samplers Field Notebooks/Sample Bank, Field Samplers
All forms filled out completely in indelible ink without alterations except as initialed.	Not Cited.	All data-recording forms.
Identify of Sampler	Section 3.0, page 13 Section 3.0, page 15	Sample Label/Sample Bank Field Notebook/Sample Bank/ Field Samplers.

TABLE 3-1
USEPA CERCLA SITE DATA CRITERIA AND SBC RI DATA (Continued)

Level B

Only data which has met level A criteria will be considered for level B. To meet level B criteria the following information must be fully documented.

Criteria	SBC RI QA Plan	Data Location
Compatibility between field and laboratory measurements or suitable explanations of discrepancy	Not Cited	For the SBC RI no field measurements were repeated in the laboratory.
Analysis within time limits suitable for the preservation and analysis method used.	Section 3.0, page 10	Those analyses past the indicated holding times are reported as not validated.
Sample storage within suitable temperature, light, and moisture conditions.	Section 3.0, page 10	All samples were stored by the sample bank's sample custodian in appropriate sample storage areas. Water samples were stored in closed coolers or refrigerators. Solid samples and archived water samples were stored on Sample Bank shelves. The Sample Bank area had controlled temperature, light, and moisture conditions.
Proper sample containers used.	Section 3.0, page 10	All sample containers were dispensed by the sample custodian using the list in the SBC RI QA Plan.
Proper sample collection equipment used; properly decontaminated; not biased.	Section 3.0, pages 1-9	Field notebooks/Sample Bank and Field Samplers.

TABLE 3-1
USEPA CERCLA SITE DATA CRITERIA AND SBC RI DATA (Continued)

Level B

Only data which has met level A criteria will be considered for level B. To meet level B criteria the following information must be fully documented.

Criteria	SBC RI QA Plan	Data Location
A comprehensive evaluation of all factors indicates data was not pre-screened by any party using different criteria than that contained herein (bias screening).	Not applicable	Not applicable
Sample site selection criteria provide representativeness.	Section 2.0, page 3	Sampling techniques and sampling sites were identified in the SBC RI Work Plan. These sites were selected to be representative of the populations of interest.

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4.0 IMPLEMENTATION

The following is a summary of implementation procedures for the SBC RI QA Plan.

4.1 FIELD ACTIVITIES

The field crews were responsible for implementing the sample collection aspects of the SBC RI QA Plan:

- Acquire the sample containers from the Sample Bank;
- Follow the appropriate protocol or procedure as described in the Work Plan for sample collection;
- Use the appropriate containers and preservatives;
- Label the sample containers;
- Appropriately decontaminate sampling equipment;
- Fill out the Field Notebooks;
- Start the Chain-of-Custody Forms;
- Fill out the Analysis Request Forms;
- Perform appropriate field instrument calibration and maintenance;
- Prepare field blanks;
- Insure sample custody;
- Prepare field duplicates;
- Submit samples to the sample bank;
- Make replicate field measurements;
- Submit field data for input to Data Management System;

- Review preliminary data reports for verification of field data; and
- Review preliminary data reports for validation of laboratory data.

4.1.1 Water Samples

Surface-water and ground-water samples were collected by crews from Stiller and Associates, Inc. of Helena, Montana. David Stiller was the Hydrologic Sciences Task Leader responsible for sample collection.

4.1.2 Soil and Tailings Samples

Several SBC RI investigations collected soil and tailings samples. The investigation name and responsible Principal Investigator are listed below:

- Agricultural Investigation (soil)-Jay Cornish, MultiTech, Butte, Montana;
- Ground Water and Tailings Investigation (tailings)-David Stiller, Stiller and Associates Inc., Helena, Montana; and
- Warm Springs Ponds Investigation (tailings and bottom sediments)-David Stiller, Stiller and Associates, Inc., Helena, Montana.

4.1.3 Biological Samples

Several SBC RI Investigations collected biological samples such as fish, duck, and vegetation tissue. The investigation name and responsible principal investigator are listed below:

- Fish Tissue Investigation (fish tissue) - Robert Trout, MultiTech, Butte, Montana;
- Waterfowl Investigation (waterfowl tissue) - Robert Trout, MultiTech, Butte, Montana; and
- Agricultural Investigation (plant tissue) - Jay Cornish, MultiTech, Butte, Montana.

4.2 LABORATORY ACTIVITIES

The MultiTech laboratory maintained a physically and functionally separate Sample Bank during the SBC RI. Laboratory activities were:

4.2.1 Sample Bank (Sample Control)

- Dispense sample containers, preservative, and decontamination solutions;
- Dispense chain-of-custody and analysis request forms;

- Receive and inspect samples from field crews;
- Receive, check, and file chain-of-custody forms, analysis request forms, and field notebook copies;
- Generate laboratory numbers and enter sample log-in data in laboratory logbooks;
- Generate and maintain records for blind blanks, duplicates, standards, and spikes;
- Check out samples to analysts;
- Transmit reference laboratory samples;
- Archive samples after analysis; and
- Calculate concentrations or recoveries for blind blanks, duplicates, standards, and spikes.

4.2.2 Analysis

- Prepare samples for analysis;
- Prepare calibration standards;
- Perform appropriate calibrations;
- Analyze samples;
- Prepare QC calibration checks, duplicates, and spikes;
- Analyze QA and QC samples at required frequencies;
- Implement appropriate corrective action for out-of-control analyses;
- Calculate results in appropriate units;
- Generate preparation, analysis, and QC records as required in the SBC RI QA Plan;

4.2.3 Data Review

- Review analyst data sheets and calculations;
- Review sample bank (QA) and analyst prepared (QC) results for compliance with SBC RI QA Plan requirements;

4.2.4 Document Control

- Maintain central file of all field, log-in, analysis, QA/QC, and data review records;
- Maintain inventory of all field, log-in, analysis, QA/QC, and data review records;

4.2.5 Laboratory Maintenance

- Maintain sample bank and analysis supplies;
- Maintain calibration solutions;
- Clean labware and sampling containers as required by SBC RI QA Plan; and
- Maintain laboratory equipment through a regular program of inspections and performance checks.

4.3 PROJECT QA OFFICER

MultiTech's SBC RI Project QA Officer responsibilities included:

- Periodic review of laboratory procedures and documents to ensure compliance with the SBC RI QA Plan;

- Periodic review of field QA activities;
- Respond to external reviews of analytical data;
- Validate data; and
- Prepare project QA Report.

4.4 PROJECT MANAGEMENT

MultiTech's project management responsibilities for QA included:

- Ensure that the QA Plan was properly implemented;
- Periodic review of reports;
- Initiating and responding to external audits;
- Coordinate external and internal QA reviews;
- Request QA Plan revisions;
- Provide overview of QA activities; and
- Approve/disapprove final release of reports to MDHES.

4.5 PROJECT OVERSIGHT

The State Project Officer (SPO), Mike Rubich of MDHES, and the Remedial Project Manager (RPM), Lee Shanklin of the USEPA (Helena, Montana Office), had oversight responsibilities for the SBC RI:

- Release data for review;
- Release reports for peer review;
- Provide direction and decisions on Data Quality Objectives;
- Obtain USEPA and MDHES approval of the SBC RI QA Plan and proposed revisions; and

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5.0 EXTERNAL AUDITS

MultiTech's Laboratory was audited by the Environmental Monitoring Systems Laboratory (EMSL), a team from the U.S. Environmental Protection Agency (USEPA), who conducted a special on-site laboratory evaluation in July of 1985. Techlaw (a contractor to the USEPA) conducted a simultaneous National Enforcement Investigations Center (NEIC) Evidence Audit. The audit comments and MultiTech responses are presented in Tables 5-1 and 5-2 for the EMSL Laboratory Evaluation and the NEIC Evidence Audit, respectively.

In June of 1986 an exit audit of MultiTech's lab was conducted by a representative of CDM, Denver, Colorado. At the time of this report completion the Audit report was unavailable. The report and MultiTech's responses will be on file at MDHES offices in Helena, Montana.

TABLE 5-1
EMSL SPECIAL ON-SITE LABORATORY EVALUATION-COMMENTS AND RESPONSES

Recommendation	Response
1. Temperature logs should be started for the refrigerators.	1. Implemented as requested
2. The air flow in the hoods should be recorded. Also the sample digestion hoods should be periodically cleaned.	2. Hood flow will be monitored and recorded. Past practice has been to qualitatively note satisfactory hood flow. Each hood is independently powered, ducted and vented, therefore flow-problems observed with more complicated multiple baffle and partial recirculate systems are unlikely. The fan motor for each hood is mounted on the exterior surface of the roof immediately above the hood; an analyst using a hood can hear whether or not the hood fan is operating. The building heating system operates at neutral pressure so that flow reversal in the hoods, even when the fan is off, is unlikely. Hoods and associated ducts are cleaned periodically.
3. A daily log on reagent water conductivity should be started.	3. Implemented as requested. Previous practice was to continuously maintain conductance and change the D.I. cartridges whenever the resistance was less than 2 megaohms.
4. A standards tracking system should be started so that preparation date, preparer, manufacturer and lot number can be traced to a solution used to calibrate an instrument.	4. Implemented as requested.
5. A system for tracking atomic absorption performance (i.e., signal vs. concentration) should be started. This information could be recorded in the run log.	5. Signal response is now recorded in absorbance units. This information is recorded on analysis data sheets. This information will be transferred to control sheets.
6. Outside service should be recorded in the daily maintenance logs for the AA and ICP.	6. Implemented as requested.

TABLE 5-1
EMSL SPECIAL ON-SITE LABORATORY EVALUATION-COMMENTS AND RESPONSES (cont.)

7.	Whiteout and obliterations were observed on some documents. Mistakes should be crossed out with a single line and initialled.	7. Implemented as requested.
8.	The balance should be checked daily or before use with a class "S" weight.	8. Implemented as requested. Balance checks are recorded in the balance log.
9.	The glassware cleaning procedure should be posted above the sink.	9. Implemented as requested.
10.	Work reviewed by supervisors should be initialled by the reviewer.	10. Currently, all work is reviewed by the the laboratory director or QA officer, or both. Henceforth, data sheets will be initialled as they are reviewed.
11.	A hood should be considered for opening coolers in the sample storage room.	11. Samples suspected of being high hazard samples are opened in the hood.
12.	The possibility of interferences in the turbidimetric sulfate method should be addressed in the laboratory's SOP for this analysis.	12. Implemented as requested.

TABLE 5-2
NEIC EVIDENCE AUDIT-COMMENTS AND REPSONSES

Recommendation	Response
1. Sample receipt SOPs should be revised to reflect the current format and storage location of the master log.	1. The SOP is being revised to indicate the exact log book format and to indicate that the log books are stored in the main lab office rather than the sample bank file cabinet.
2. SOPs for sample and laboratory security should be developed and implemented.	2. The SOP is being revised as recommended regarding locking the sample bank. Procedures for further controlling access to the building are being developed and will be noted in an SOP revision.
3. Sample preparation should be documented, and this documentation should be included in the case files.	3. Sample preparations are being documented and sample preparation sheets will be included in case files.
4. Instrument-use logs should be developed and maintained.	4. Instrument use logs for AA and ICP work are being used as recommended.
5. All EPA documents related to a particular sampling episode should be placed in a sample file.	5. This is being done in conjunction with the document inventory (Item 10).
6. ICP printouts should be initialed by the analyst.	6. Implemented as requested.
7. All data should be recorded in ink.	7. Implemented as requested.
8. Analyst's notes should be consistently signed and dated.	8. Implemented as requested.
9. Errors should be corrected by drawing a simgle line through the error, then initialing and dating the correction.	9. Implemented as requested.
10. Document inventories should be developed for EPA case files.	10. SBC RI documents are being inventoried.
11. SOPs for document filing should be developed and implemented.	11. The SOP is being changed and amended to reflect Items 5 and 10, and will be implemented accordingly.

6.0 QUALITY ASSURANCE/QUALITY CONTROL DECISIONS

Corrective actions taken for quality assurance (QA) and quality control (QC) reasons during the SBC RI were classified into three categories:

- Immediate corrective action;
- Validation corrective action; and
- Long-term corrective action.

6.1 IMMEDIATE CORRECTIVE ACTION

Decisions and subsequent corrective actions made by analysts and field personnel while taking a measurement or performing an analysis were classified as immediate corrective actions. These decisions and subsequent actions were documented in field notebooks and analyst worksheets. Examples of these decisions and actions included:

- Finding internal QC measurements (KSA%, RSA%, or DSA%, SSR%) out-of-control and re-running the accompanying batch of ten samples;
- Finding the calibration curve was inadequate and recalibrating;
- Finding a problem with a sampling tool and resampling;
- Finding a problem with a proposed sampling method and modifying the method to meet field conditions (i.e. pump failure, icing, etc.); and
- Discovering instrument failure (weak batteries or poor connections) during a measurement and re-measuring.

6.2 VALIDATION CORRECTIVE ACTIONS

During the validation process all sample data and internal and external QA/QC data were reviewed. Decisions and actions taken as a result of this review were classified as validation corrective actions. The three parties performing the validation review included the Project QA Officer, the Lab Director, and the sample collectors/ data users. Validation decisions and subsequent actions were documented with memos to the appropriate sample bank case file. Examples of validation decisions and corrective actions included:

- Finding blanks at greater than the MDL and requesting a re-analysis;
- Finding internal QA/QC checks out-of-control and either requesting a re-analysis or invalidating data (if sample was past holding time).
- Finding external QA/QC check (Sample Bank and field) out-of-control, investigating the cause (checking calculations, evaluating spike levels, etc.) requesting re-analysis, checking preparation, and noting reasons.
- Finding transcription errors in field data and correcting report sheets.
- Finding sample data that did not meet data expectations (such as data from a previous sampling of the same well or surface water station), analysis, checking calculations and calibration curves, requesting a re-analysis, and reporting validated or invalidated data depending on circumstances.

6.3 LONG-TERM CORRECTIVE ACTION

Data users and data producers each have unique perspectives on data validity and potential use. Data users are interested in receiving data that allows them to meet their Investigation Objectives. Data

producers are dependent on data users to communicate their needs. This communication results in establishing measurement methods and resulting data accuracy, precision, and MDL's. Changes in data quality objectives and misunderstandings between data users and data producers can lead to long-term corrective actions. External audit findings and internal operating findings can also lead to long-term corrective actions. These decisions and actions are fully documented in SBC Project Files at MultiTech with letters and internal memos. A summary of the long-term corrective actions is given in Table 6-1.

TABLE 6-1
SBC RI - SUMMARY OF LONG TERM CORRECTIVE ACTIONS

Date of Correspondence	Correspondence Received by	Reason For Corrective Action	QA/QC Decision or Corrective Action
11-21-84	Stiller and Assoc. Helena, MT.	No decontamination procedure in QA Plan for dispensable field filter units.	Memo issued with prescribed decontamination procedure.
1-10-85	Gordon Huddleston, PM MultiTech, Butte, MT. Mike Rubich, SPO, MDHES. Helena, MT. Stiller and Associates, Helena, MT.	Inaccurate reporting of TDS and TSS data	Specific analysis work sheets prepared.
1-29-85	Mike Rubich, SPO MDHES, Helena, MT.	Comparability of tailings data questionable due to proposed methods	Methods for tailings analysis changed to improve data comparability.
2-19-85	Mike Rubich, SPO MDHES, Helena, MT.	QA Plan needed revising to address USEPA comments on Draft QA Plan, address new or unanticipated procedures and make corrections.	Proposed revisions submitted to MDHES for approval. See discussion in Section 1.0 of this report for further details.
3-5-85	Laboratory Staff MultiTech Butte, MT. Stiller and Associates Helena, MT.	Inconsistent use of significant figure rules.	Memo issued with prescribed significant figures for each SBC RI measurement.

TABLE 6-1
SBC RI - SUMMARY OF LONG TERM CORRECTIVE ACTIONS (Continued)

Date of Correspondence	Correspondence Received by	Reason For Corrective Action	QA/QC Decision or Corrective Action
3-7-85	Stiller and Associates Helena, MT. Gordon Huddleston, PM MultiTech, Butte, MT.	Cation-Anion balance unknown due to not analyzing for all major cations and anions.	Two surface water sampling episodes were selected for analysis and reporting of all major cations and anions.
3-7-85	Stiller and Associates Helena, MT. R. Trout, QAO, MultiTech, Butte, MT.	Problems with evaluating domestic wells to obtain a representative sample.	Memo issued with prescribed method of obtaining a sample from domestic wells.
3-22-85	Stiller and Associates Helena, MT.	Lack of QA/QC data on field measurements.	Memo issued that prescribed a schedule of obtaining precision QA/QC data on field measurements.
3-15-85 3-22-85 4-11-85	Mike Rubich, SPO MDHES, Helena, MT.	Data quality objectives and MDL's discussion.	Final letter issued requesting MDHES approval of USEPA CLP MDL's for the SBC RI. See Section 2.0 of this report for further discussion.
8-26-85 (2-6-86)	MultiTech Lab Staff (Mike Rubich, SPO) MDHES, Helena, MT.	USEPA EMSL Lab Audit Recommendations	Recommendations implemented.
9-23-85	Mike Rubich, SPO MDHES, Helena, MT.	USEPA Techlaw NEIC Evidence Audit	Recommendations implemented.
9-5-85	Gordon Huddleston, PM MultiTech, Butte, MT.	Cu MDL's not meeting MDL goal (CLP MDL).	Requested reanalysis performed on 92 samples.

TABLE 6-1
SBC RI - SUMMARY OF LONG TERM CORRECTIVE ACTIONS (Continued)

Date of Correspondence	Correspondence Received by	Reason For Corrective Action	QA/QC Decision or Corrective Action
No date (Telephone conversation)	Dr. Clarence Whitworth Lab Director MultiTech	Cu and Zn MDL's not low enough for data user (Bioassay samples)	Requested concentration and re-analysis performed on approximately 400 samples.
1-26-86	Robert Trout, QAO MultiTech, Butte, MT	Tailings sample size inadequate for requested analyses.	Memo issued with priority listing.

DRAFT

7.0 SBC RI DATA QUALITY OBJECTIVES

The stated objective of the SBC RI was to determine the extent and severity of contamination in Silver Bow Creek and the upper Clark Fork River. This data then will be used to evaluate human and environmental risk from the contaminants and to identify potential remedial actions. SBC RI data uses, therefore, are five-fold:

- Determine extent of contamination. Data used for this purpose must allow an investigator to pinpoint sources, transport mechanisms, and receptors of contaminants;
- Determine severity of contamination. Data used for this purpose must be quantitative, not qualitative, and accurate to some acceptable degree of accuracy;
- Determine human risk. Data used for this purpose must have appropriate MDLs, precision, and accuracy for comparison to standards for human protection;
- Determine environmental risk. Data used for this purpose must have appropriate MDLs, precision, and accuracy for comparison to standards for ecological protection or literature data on tolerances and environmental effects.
- Identify potential remedial actions. Data used for this purpose must have appropriate MDL's, precision, and accuracy to allow engineering remedial actions to be identified and conceptually tested.

Meeting these requirements for any measurement of interest is an action which balances the cost, time, MDL, precision, accuracy, comparability, and use of the data. On the SBC RI every effort was made during planning to identify the methods and procedures for data production that would meet the needs of the investigations and their role in meeting the overall objectives of the SBC RI. Flexibility also was built-in (and exercised) to allow changes during

the project. The flexibility allowed the project to meet its data quality objectives and provided the data quality necessary for meeting project objectives.

The question of data quantity (are the data sufficient for drawing the conclusions and making the comparisons?) must be answered on a case-by-case basis. The SBC RI Feasibility Study will identify data shortfalls.

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